U. S. DEPARTMENT OF AGRICULTURE

BULLETIN

OF THE

MOUNT WEATHER OBSERVATORY

VOLUME I

William J. Humphreys, Ph. D., Director

William R. Blair, Ph. D., Assistant Director

PREPARED UNDER THE DIRECTION OF

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CHIEF U. S. WEATHER BUREAU

WASHINGTON

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1908

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FRONTISPIECE.

Administration building, Mount Weather, Va.

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ANNOUNCEMENT.

The Bulletin of the Mount Weather Observatory, of which this is the first number, will contain more or less detailed accounts of the researches conducted at that place. In this way the conclusions reached and the data upon which they are based can best be placed before the officials of the Bureau, and incidentally be brought to the attention of others working along similar lines. It will appear quarterly, in such form and size as a proper presentation of the material may require, so that those who need it may have the information it contains as quickly as possible.

The meteorological service of the United States Government is comprised of many stations distributed over a broad area, but until the founding of Mount Weather no station was specifically devoted to research work. The position that the Weather Bureau now occupies in the United States and before the world justifies research into the fundamental principles that underlie meteorological science. Such research will give information and direction to the two hundred stations that are taking observations and making forecasts.

In the application of known principles to the art of weather forecasting the Weather Service of the United States is doubtless in the forefront; on the other hand, it has not done its full part in the way of discovering new principles; therefore, it was high time that such an institution as Mount Weather be founded so that the scientists of the Weather Bureau might have placed at their disposal facilities for research that will enable them to better understand the influences that control weather conditions.

James Wilson

Secretary of Agriculture.

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THE ORIGIN AND THE PURPOSE OF THE MOUNT WEATHER OBSERVATORY.

In 1870 the United States Government undertook the important work of forecasting to-day what kind of weather might reasonably be expected to-morrow. This service, because of its value to the industries of the country, has rapidly grown and we now get reports twice daily of the surface conditions of temperature, moisture, rainfall, wind velocity and direction, and other data from more than two hundred stations in the United States, West Indies, Mexico, Canada, and elsewhere.

From this information the forecaster now makes predictions for the coming two days with such success that they are of service to nearly every class of people. But the more accurate this forecasting, and the greater the length of time ahead to which it can be made to apply, the greater is its value—the ideal condition being the forecasting of the type of season to expect together with detailed forecasting from day to day. A knowledge of the type of the coming season will, among other things, tell the farmer what crops to plant, while the daily forecasts advise him in regard to cultivating and harvesting, and when safely to ship. These ideal conditions, however, do not exist at the present time, and can not be had without a great deal more knowledge than we now possess of the interrelations of meteorological phenomena. Forecasting, that practical part of meteorology so valuable to the public, is an art that can improve only as our knowledge of the underlying science is increased, and therefore it seems proper for the Government to undertake to add to that knowledge.

Anything so extensive as general meteorological investigations can not be undertaken with much hope of success by an individual, nor is it practical for private institutions to do so, tho much of value is constantly appearing from these sources. Many of the needed investigations of storms, for instance, require simultaneous observations made at different places, and some of them demand for their solution years of continuous work. From these and other similar considerations it is imperative that the Weather Bureau push investigations of this nature as vigorously as possible, and in every way that seems hopeful

of success. But from the difficulty and complexity of the problems involved the improvement of the forecasting may be only imperceptibly gradual, just as have been the improvements in every other art and science, but it is certain that this is the only way by which improvements can be made, and it is equally certain that so long as this kind of work is continued the predictions in the future will continue to improve over those of the past.

The possible investigations are very numerous, but in general may be classed under some one of the following heads:

(*a*) Studies of the atmosphere at the surface of the earth and at various altitudes; determinations of its temperature, moisture content, pressure, state of electrification, direction and magnitude of its movements, its cloudiness, dust content, absorption of light, of heat, and of electric waves, and its various other properties.

(*b*) Solar investigations; involving a careful measurement of the insolation, or amount of solar energy reaching the earth in a unit of time, the size and distribution of sun spots, faculæ, and prominences; and an especial effort to detect all changes in the registered amounts of the solar energy, and a careful effort to refer these changes to their real causes, whether of terrestrial or of solar origin.

(*c*) Terrestrial magnetism—a study of the regular and of the irregular changes in the magnitude and direction of the earth's magnetic force, in connection with other terrestrial phenomena and with solar activities of all kinds.

(*d*) Laboratory investigations—the reproduction under controllable conditions of various meteorological phenomena, and experiments that may aid in explaining the origin and laws of weather conditions; also the construction and standardizing of certain apparatus.

Since all these different lines of investigation have a common object—the solution of meteorological problems and the improvement of forecasting—they are, therefore, more or less intimately related and interdependent, and obviously would better be carried on simultaneously, and so far as possible at the same place and under the same general management. The location should be suitable for the various investigations likely to be taken up, and the management should give all possible freedom and encouragement to individual investigators consistent with proper coordination and unity of purpose.

The study of the upper air, demanding as it does the daily use of kites, requires a location with a high average wind velocity, and one where sometime during every day there is a strong probability of having a wind of at least 8 to 10 miles per hour. It also calls for a loca-

tion 10 miles or more away from cities and electric light wires, since at such localities the loose wire falling down as a result of some accident to the kites during a storm would be very troublesome and even a source of danger. Besides the surrounding country for 15 to 20 miles should be comparatively open, so that lost kites and their instruments may the more readily be recovered.

The magnetic work also requires a location remote from cities, and from trolley lines, and free from beds of iron ore. The solar work calls for a place away from the smoke and dust of cities and above the haze of valleys; while the needs of the physical laboratory can be met nearly as well at one place as at any other, provided only that it is free from the disturbing jars of heavy traffic.

Obviously too it is desirable to have this important part of the Bureau's work done as near as practicable to Washington so that the Central Office may be in close touch with it.

Mount Weather Observatory, the name of the group of laboratories and observatories where the Weather Bureau is doing this work, well meets these conditions. It is 1,725 feet above sea level, and is located in Virginia, on the top of the Blue Ridge Mountains, some 20 miles south of Harpers Ferry, and 47 miles in a direct line from Washington. It is only 6 miles from Bluemont, the nearest railroad station, and is easily reached from that point along an excellent mountain road. It overlooks to the west the entire Shenandoah Valley from Strasburg to Harpers Ferry, while to the east all that portion of Piedmont Virginia between the Blue Ridge and the Bull Run mountains is in full view. This extensive sweep of valleys, mountains, and plains affords rare opportunities for the study of storm formation and action. This location is satisfactory for the physical laboratory, and for the magnetic observatories. For solar work it is as well adapted as any place east of the Rocky Mountains; while for the study of the upper air it is peculiarly well situated, since kite flights can be obtained there almost daily thru the entire year.

The ground for this observatory was purchased September 22, 1902, and the contract for the central or administration building let December 20, of the same year. Since then the observatory has gradually grown both in extent of plant and in scope of work.

At present the administration building[1] at Mount Weather is well equipped with apparatus for determining and automatically registering the atmospheric pressure, direction and velocity of the wind, sun-

[1] The administration building and its contents were totally destroyed by fire on the morning of October 23, 1907.

shine, rainfall, temperature, and humidity; in short it is equipped as a first-class meteorological station, and the data secured are regularly telegraphed to the Central Office in Washington twice daily and used in all forecasts for this part of the country. Besides this instrumental equipment the administration building contains offices and several living rooms, all well adapted to the needs of the place.

The aerial department is provided with an engine and dynamo, an electrolytic plant for generating the hydrogen used for the balloons, and tanks for containing this gas, a liquid air plant to provide means for standardizing instruments at the low temperatures to which they are subjected at high altitudes, an instrument room where repairs can be made, a room adapted to kite building, a computing and testing room, and a kite storage room. It also has a small half round revolving structure which contains the kite reel, and from which the kites are flown.

Upper air data, as given by the self-registering apparatus carried by the kites, are telegraphed to Washington daily and used in forecasting. These data are also worked up in a very complete form and used in the study of the general movements and condition of the atmosphere, and it is already evident that in this way important information will be obtained.

Two small buildings are devoted to the proper housing of the magnetic apparatus, where the magnetic condition of the earth with all its periodic, its irregular, and its spasmodic changes, whether small or great, mild or violent, are automatically recorded.

These curious tracings are being studied in connection with solar and terrestrial phenomena, and it is practically certain that important relations will be found, tho it is difficult to decipher the writings of these delicate magnets.

The physical laboratory is now under roof, but is not sufficiently completed to be of any service.

Solar physics is represented by only a small shelter, but a few feet square, containing a pyrheliometer for measuring the amount and intensity of the solar radiation and the absorption of the earth's atmosphere.

When the physical laboratory is finished and the solarphysical building put up, the Mount Weather Observatory, as contemplated, will be complete. There will then be at this one place, so far as any one locality and its equipment can provide them, facilities for investigating any and every meteorological phenomenon, both directly by observation and indirectly thru experimentation. Its purpose is to be

the helping friend and not the competing rival of other places, whether public or private, and therefore every investigator engaged in research of importance to the Weather Bureau is invited to come and make use of its facilities for the prosecution of his studies. The whole aim of the observatory is the discovery, no matter how nor by whom, of fundamental truths of nature, and of their application to human welfare.

Willis L. Moore

Chief U. S. Weather Bureau.

THE METHODS AND APPARATUS USED IN OBTAINING UPPER AIR OBSERVATIONS AT MOUNT WEATHER, VA.

By Dr. W. R. Blair.

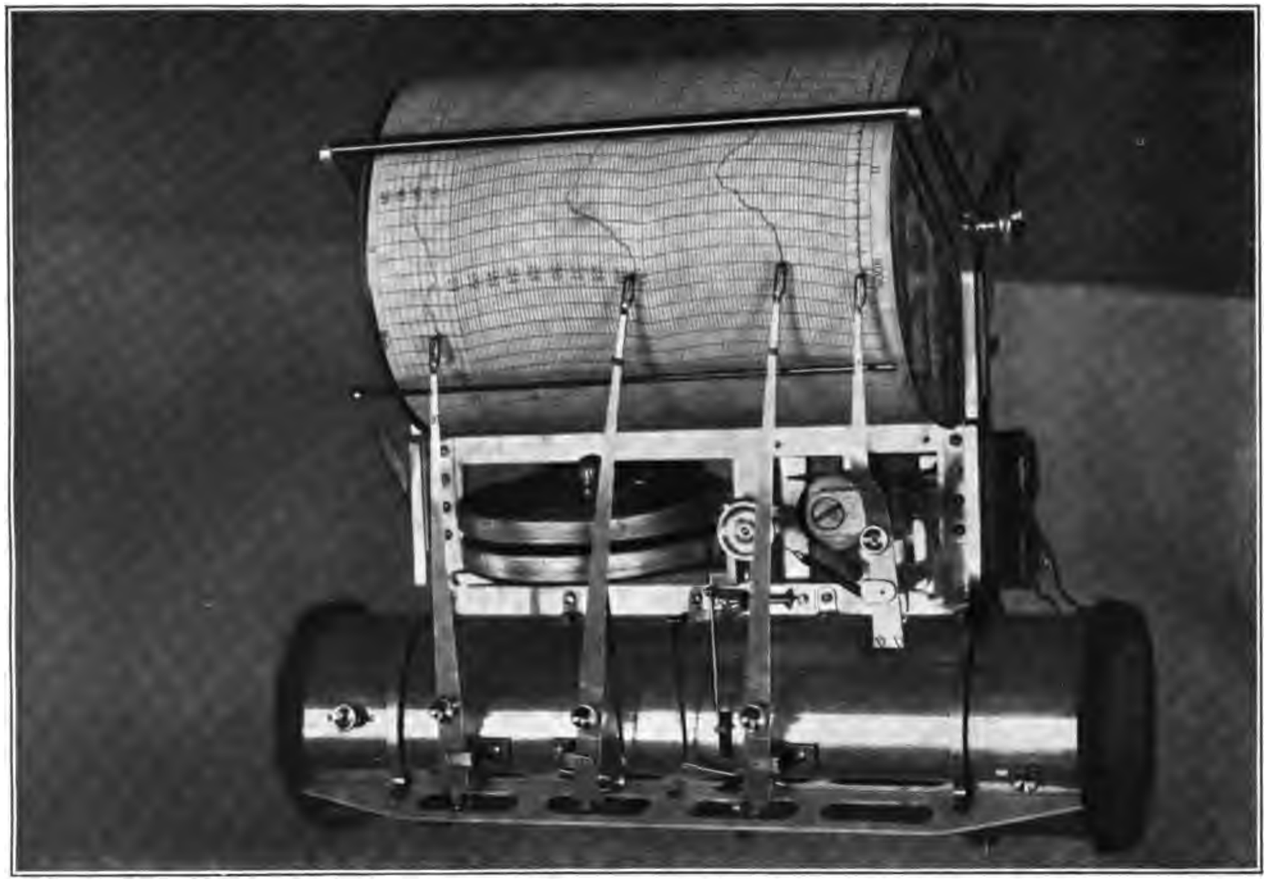
The observatory is equipped with both the Richard and the Marvin meteorographs. Most of the records for the three months given have been obtained with Richard instruments because of the fact that those of the Marvin type have been undergoing repairs and readjustments. The latter have not yet been tested and put in use since their return from the shop. The Marvin instruments have the four elements—pressure, temperature, humidity, and wind velocity—while the Richard instruments used have the first two of these elements only. Plates I and II show the meteorographs and the kind of records obtained by them. The same general principle obtains in these instruments, i. e., a cylinder rotated by clockwork, upon which the pens connected with their respective elements trace the changing conditions.

From the pressure trace, using the corrections found for the element by tests with standard instruments and surface conditions as observed at the time of flight, altitudes reached are computed. In a similar way, the upper air temperatures are determined from the temperature trace. Before and after a flight the meteorograph used is placed in a shelter with standardized instruments for the purpose of getting base lines from which to compute conditions at higher levels. As will be seen by the illustrations, frequent stops of from five to ten minutes are made on the way up and down so that the elements may have time to register accurately the condition at these levels. These stops make it possible to eliminate the errors due to sluggishness of elements and enable the observer to make frequent checks upon the time of the clock in the instrument, thus marking well the points at which accurate computation of the conditions aloft may be made. The accuracy of the final results is further secured, as above intimated, by frequent comparisons with standards of the elements of the instruments in use.

Plate IV shows the method of fastening the instrument into the kite, which is about to be launched.

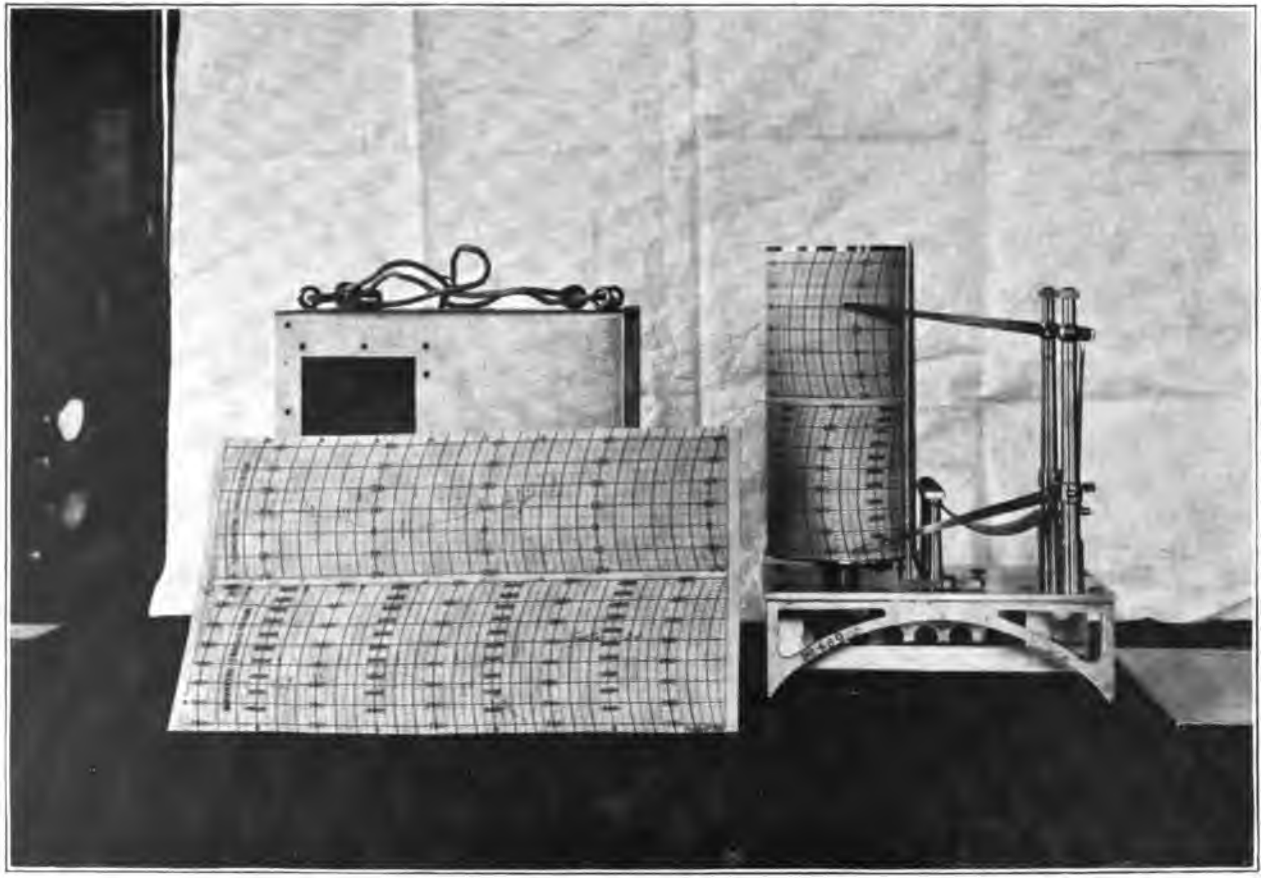
Various sizes of kites, all of essentially the Marvin-Hargrave type, have been used in the past three months. Plate V shows kites having lifting surfaces varying from 68 square feet (6.3 square meters)

Plate I.



Marvin meteorograph and record sheet.

Plate II.

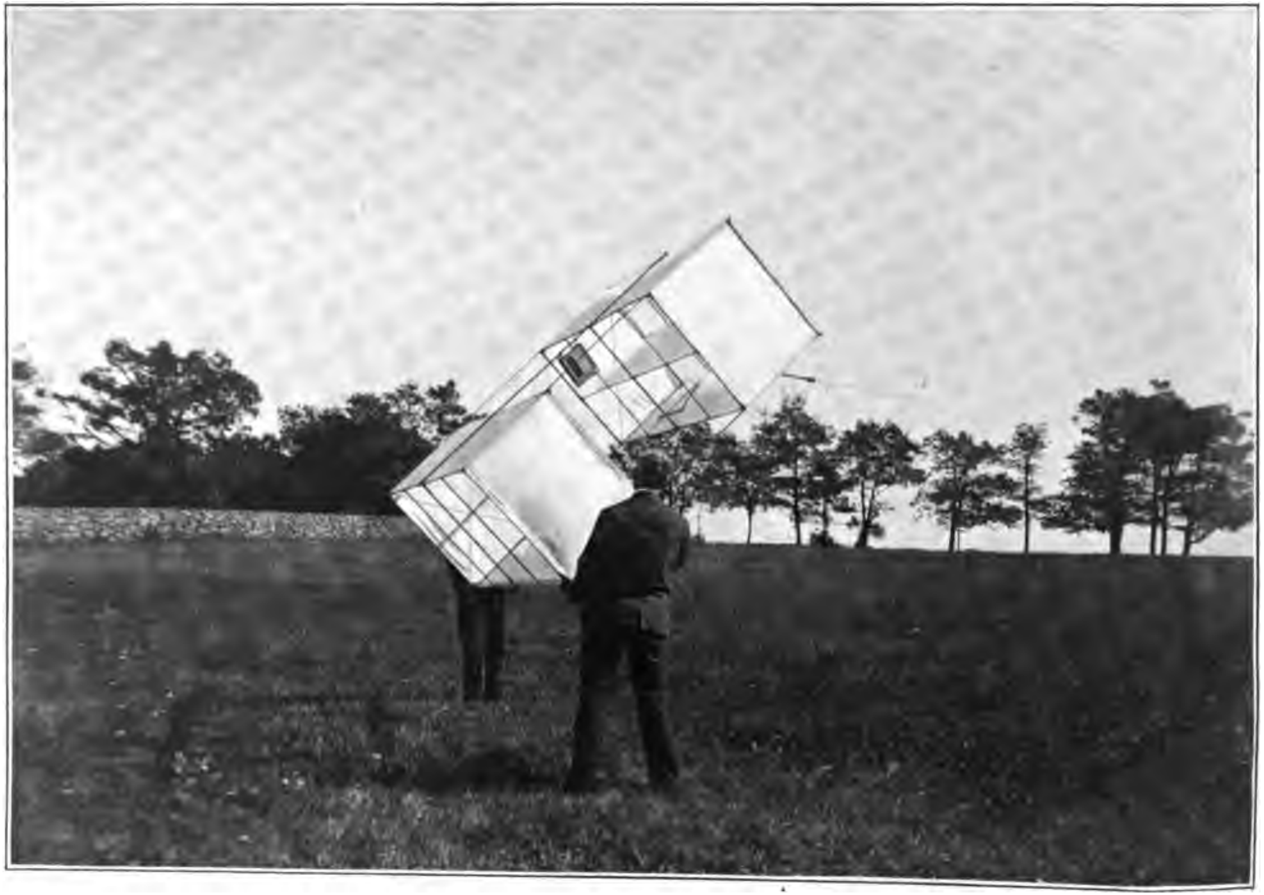


Richard meteorograph and record sheets.

Plate III.

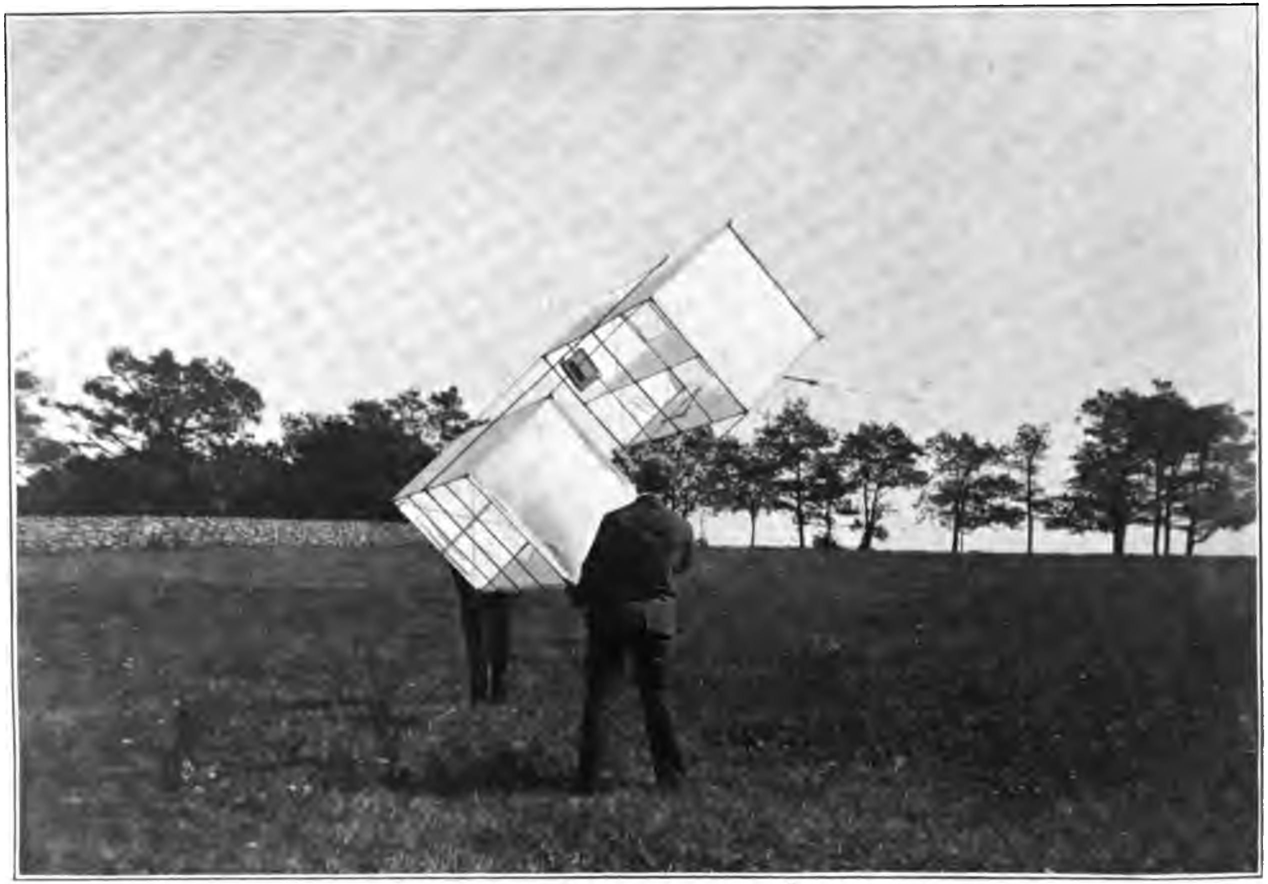
Interior of work room. Testing apparatus in corner.

Plate IV.



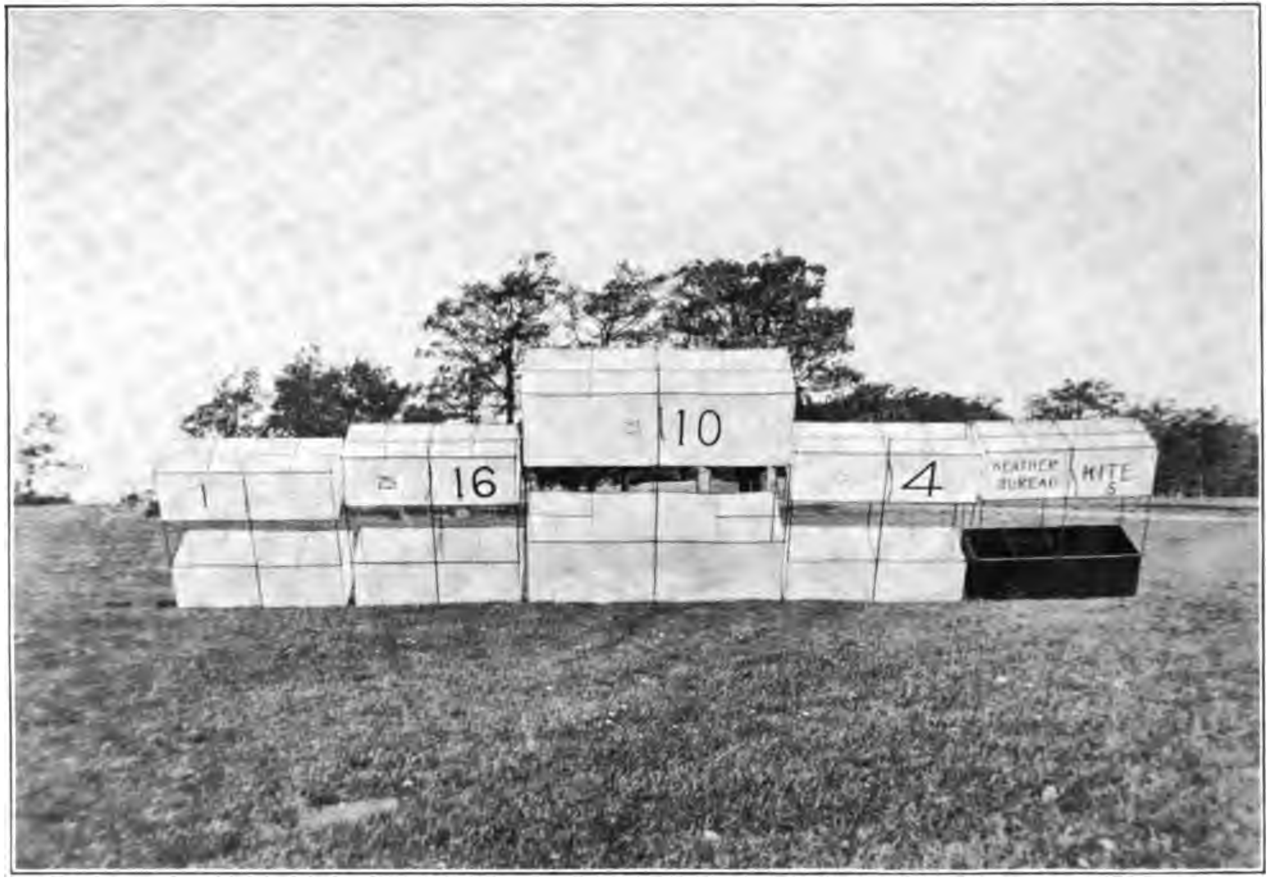
Position of meteorograph on kite about to be launched.

Plate IV.



Position of meteorograph on kite about to be launched.

Plate V.



Various patterns of kites in use.

to 150 square feet (13.8 square meters), and varying in weight from 8½ to 14 pounds (3.8 to 6.4 kilograms). The following are the dimensions of a kite having a lifting surface of 68 square feet (6.3 square meters) and steering sail 22.8 square feet (2.1 square meters) in area:

Height	6 feet 8½ inches	204 centimeters.
Width	6 feet 5½ inches	197 centimeters.
Depth	2 feet 8½ inches	81 centimeters.
Weight	8½ pounds	3.8 kilograms.
Width of planes	2 feet 1½ inches	64 centimeters.
Plane surface	2 feet 6 inches	76 centimeters.

There are five lifting planes and four steering. Kites numbered 5 and 16 have the above dimensions. Number 1 is like number 16, except that the space between the planes is 2 feet (61 centimeters) only. Number 4 has proportions somewhat similar to number 1, its height being the same as that of number 16, and its width 7 feet (213 centimeters). Number 10 has proportions somewhat similar to those of number 4. Another kite, not shown in the illustration, but one which proved very serviceable indeed as a light wind kite, is number 15, built on the plan of number 16, but having a lifting surface of 120 square feet (11.2 square meters) and weighing 12½ pounds (5.7 kilograms). The shorter kites take better angles in light winds than do the longer shaped ones, but are unsteady in winds over 25 miles per hour (11.2 meters per second).

Experiments are being made with other shapes and sizes of kites. Of these number 12, built after the pattern of the Kousnetzow kite and 4 feet 9 inches (144 centimeters) high by 4 feet 6 inches (137 centimeters) wide, has done well as a secondary kite in winds under 20 miles per hour (8.9 meters per second). Smaller Marvin-Hargrave kites in which the proportion of the steering sail to the lifting sail is greater than in number 16 have been found to behave well in winds up to 40 miles per hour (18 meters per second), and it is thought they can be used in still higher winds.

Plate VI shows the interior of the kite and balloon shed. There are 16 kites in all, experimental types being shown on the right, the others on the left.

The reel, Plate VII, carrying the line upon which the kites are flown is driven by a 3-horsepower (2.4 kilowatts) motor. The drum now in use on the reel is made of forged steel and has the dimensions shown in fig. 1, which is a sketch of its cross section. This drum is capable of carrying about 40,000 feet (12,192 meters) of piano wire line, and is loaded about as follows:

Length.		Diameter.	
Feet.	*Meters.*	*Inch.*	*Millimeters.*
2,500	762	.026	.66
5,000	1,524	.028	.71
12,000	3,658	.032	.81
20,500	6,248	.036	.91

For the purpose of attaching them to the line, the kites are provided with an elastic bridle, arranged as shown in figure 2. This arrangement not only protects the line from sudden jerks because of the elasticity

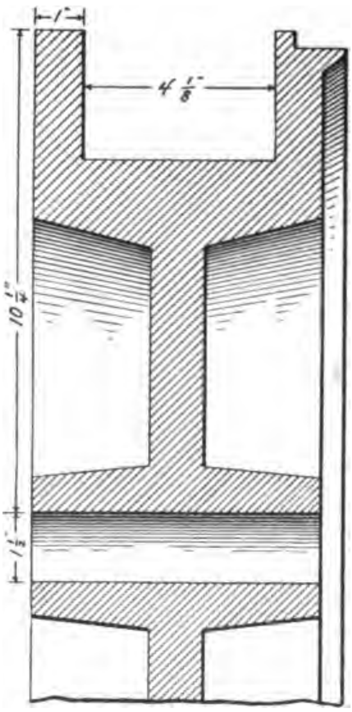
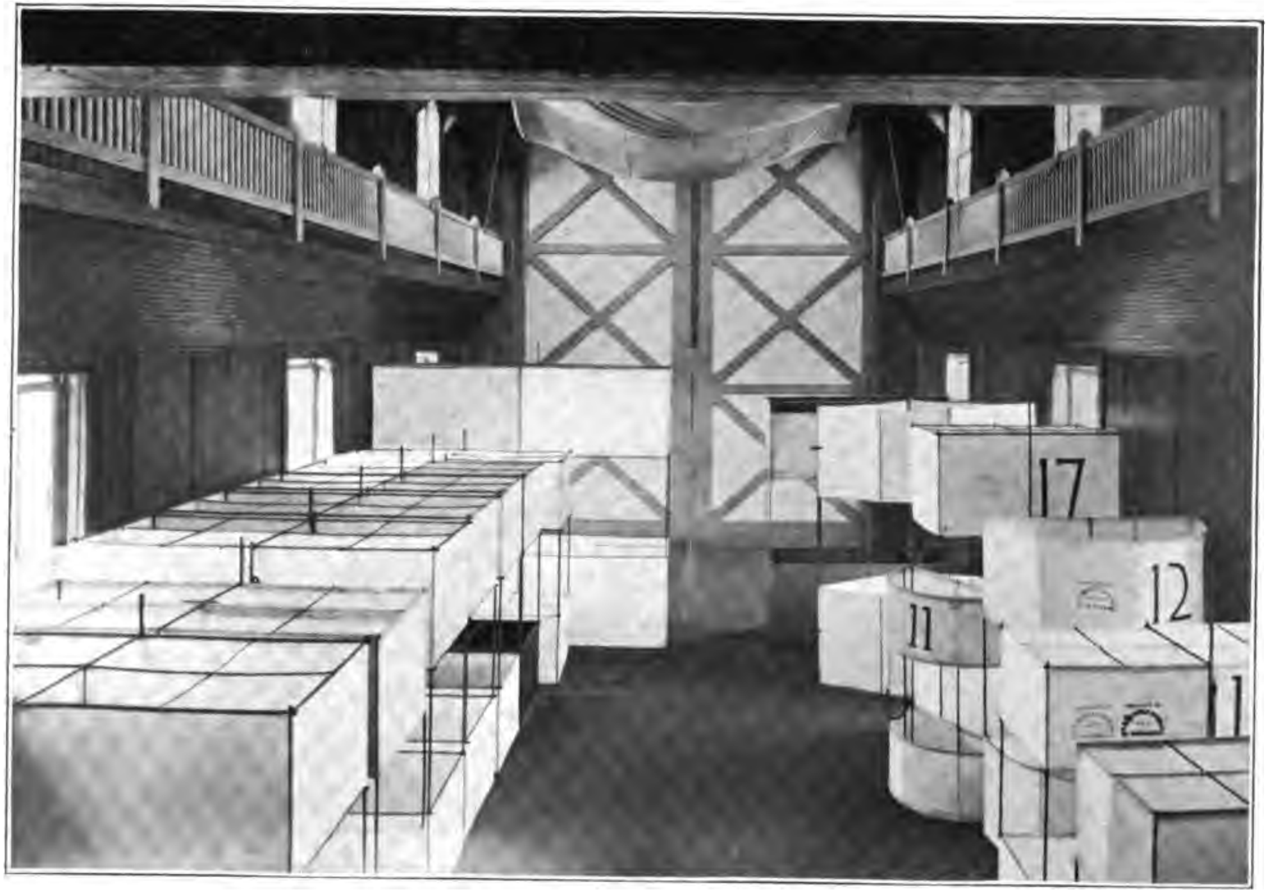


FIG. 1.—Cross section of drum.

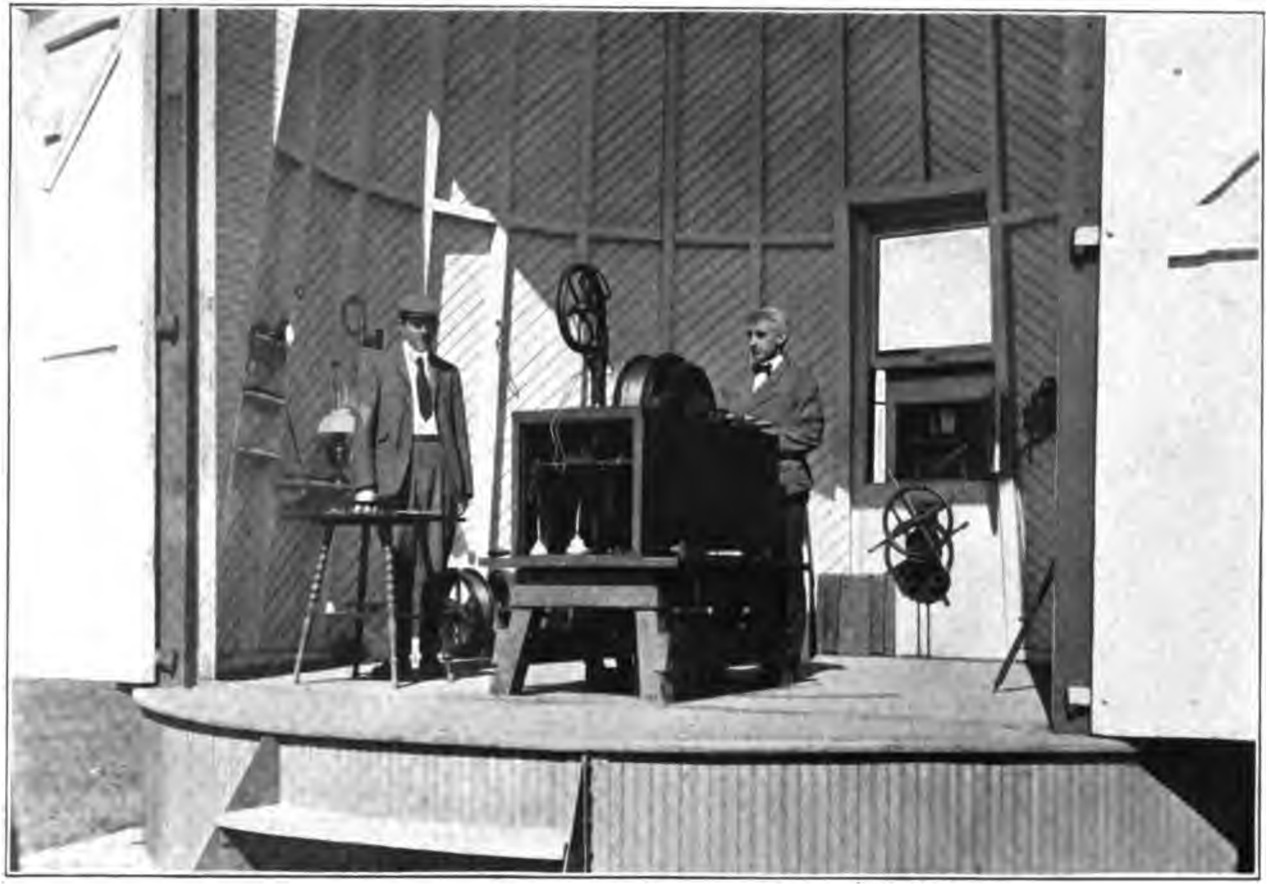
of the rubber, but as a puff of wind stretches the rubber to a considerable extent (determined by the proportions of the bridle), the point of application of the pull is transferred along the main rib to points farther up, the kite takes a smaller angle to the wind, and its pull is less than it would otherwise be. The head kite, which carries the instrument, is fastened directly to the end of the wire. Secondary kites are attached to the wire by means of cords about 100 feet (30.5 meters) in length.

Plate VI.



Kite storage room.

Plate VII.

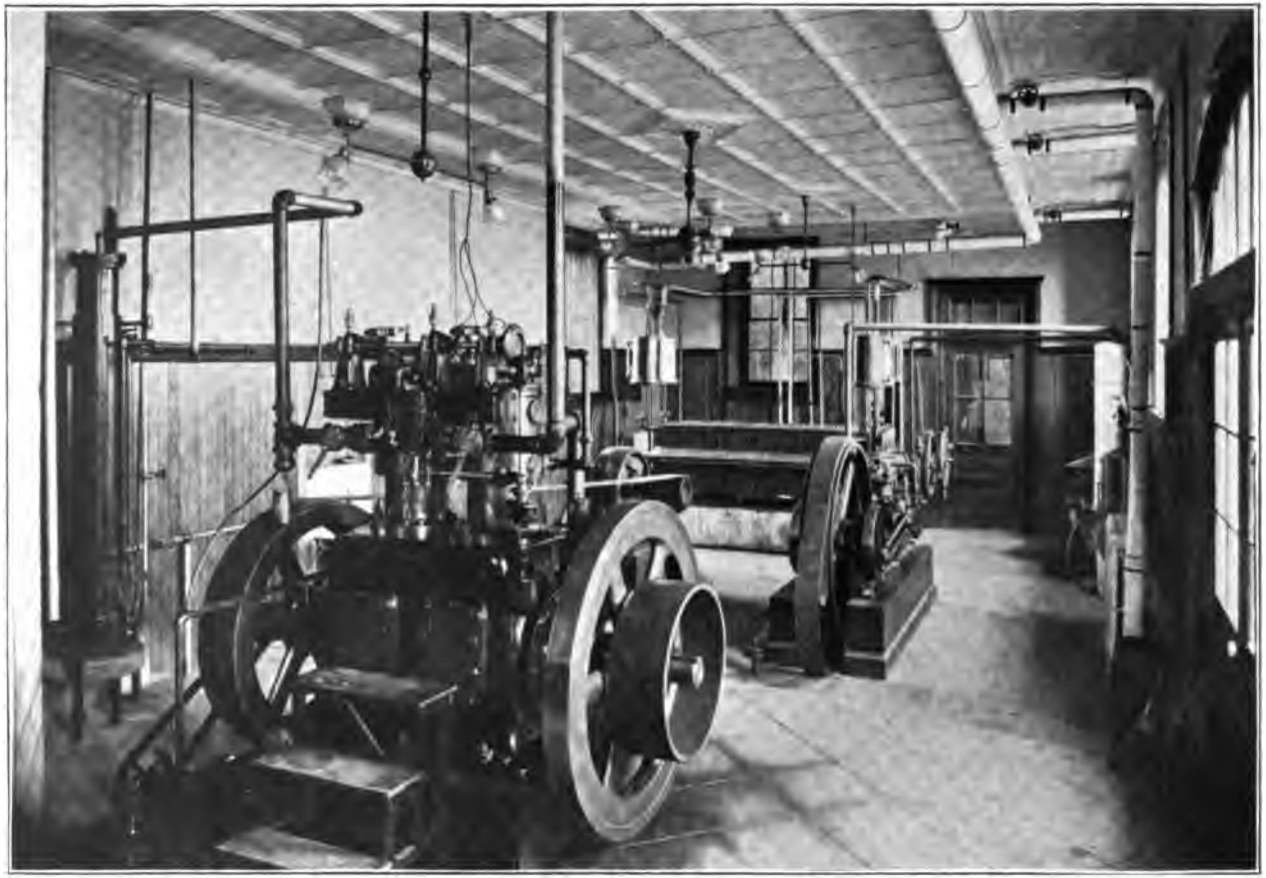


Interior of kite house, showing kite reel.

Plate VIII.

Kite field. Power house on left.

Plate IX.



Interior of power house, engine, dynamo, electrolyser, and compressor.

For the successful manipulation of kites—in starting, during the flight, and in landing—it is essential that the reel be in good running condition and completely under the control of the operator for any rate of speed from its maximum down. Unless the drum is heavy or improperly mounted there is seldom, if ever, need for reversing its rotation, the pull of the kite being sufficient for taking out wire in every case. It is probable that a thoroly satisfactory drum can not be made of cast iron. Two cast iron drums have broken at Mount Weather under the strain of about 20,000 feet (6,096 meters) of wire during the last three months, while the forged steel drum of somewhat similar dimensions has stood a test twice as severe with no apparent injury to

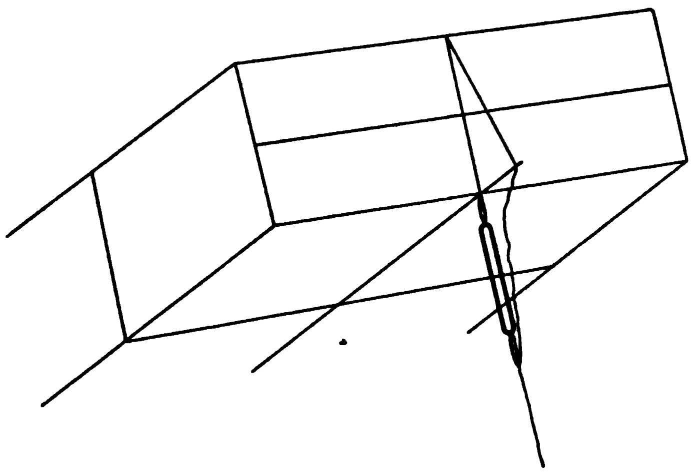


FIG. 2.—Method of attaching kite to line.

itself. The maximum speed at which it should be possible to reel in wire ought to closely approximate the wind velocity required to fly the kites used. This often makes it possible to start the kites when the surface wind is insufficient and to save both wire and kites in case they are becalmed during a flight. The maximum speed of the reel, 4.6 miles per hour (2.0 meters per second), has on one or two occasions been found insufficient, tho not seriously so; 8 or 9 miles per hour (3.5 or 4 meters per second) would be enough for any occasion which has so far arisen or is likely to arise. In addition to the necessary friction clutches for applying the power to the drum and controlling its speed, the reel is provided with an azimuth wheel over which the wire runs out in the direction required by the wind. Attached to this wheel are also devices from which may be read at any desired time the angle of

the wire at the reel and the length of wire out. These readings together with the angle of elevation of the head kite enable the observer, at any time during the flight, to know approximately the altitude at which his instrument is then recording the conditions, and serves as a rough check upon the barometric calculations of altitudes.

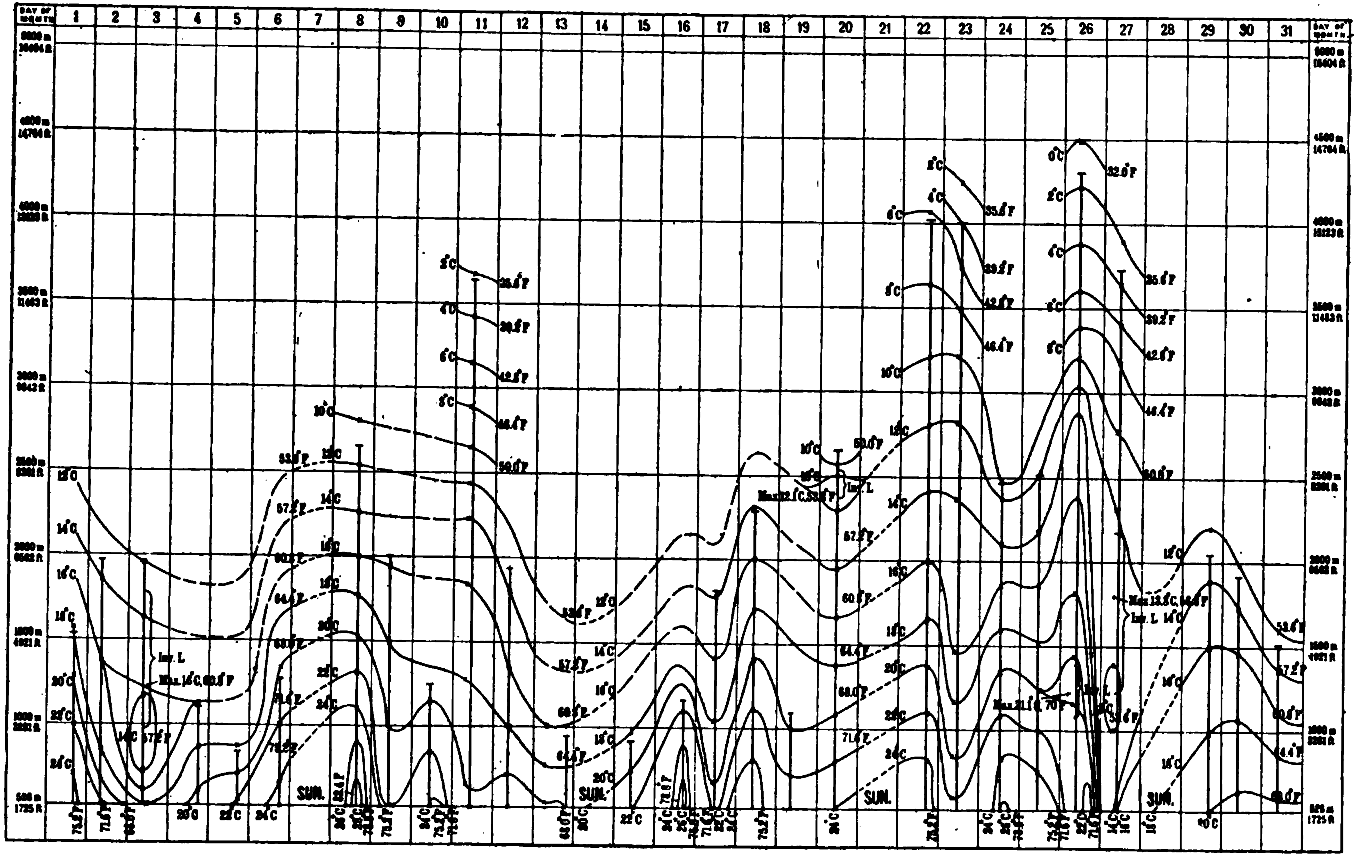
Besides the operator at the reel two men are needed for launching and landing the kites in the field and for making and recording observations at the reel. A man to be successful in the field must follow closely and be able to anticipate to some extent the kite's motion. He must decide and act almost simultaneously. The former qualification can usually be acquired by a reasonable amount of observation and experience. The acquisition of the latter in the same way is an expensive process on a kite field and can be done just as effectively by the men who can coach teams for almost any of our best college games.

During the past three months in which an average of three or four kites has been used daily, considerably less than the time of one man has been sufficient for the repairing of kites and the adding of three new kites to the previous equipment.

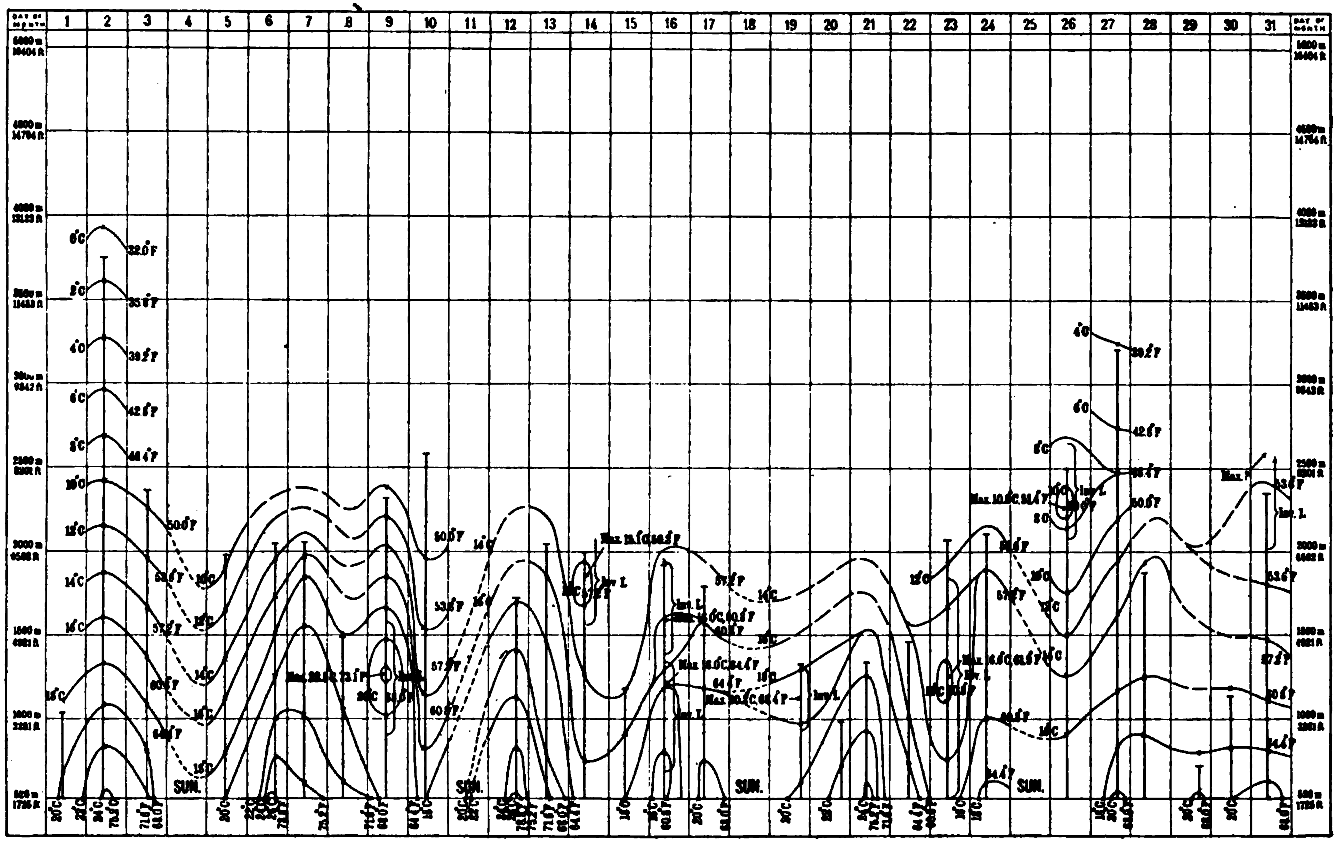
At the reel house are made continuous observations of the surface air pressure, temperature, humidity, wind direction and wind velocity during the flight. Clouds and weather conditions are observed. The amount and angle of wire out, the angle of elevation of the head kite, the number and lifting surfaces of kites out, and the hour at which levels are taken are noted.

The reel house is a circular tower mounted so that it can be rotated. Its double doors may thus be made to face in any direction, and this, together with the motion of the azimuth wheel, gives us perfect adaptation of the whole apparatus to the wind direction. An instrument shelter built onto the reel house just outside the window opposite the double doors, consequently always to the windward and well ventilated, serves to contain the standardized thermometers and the meteorographs which may be in process of comparison with them.

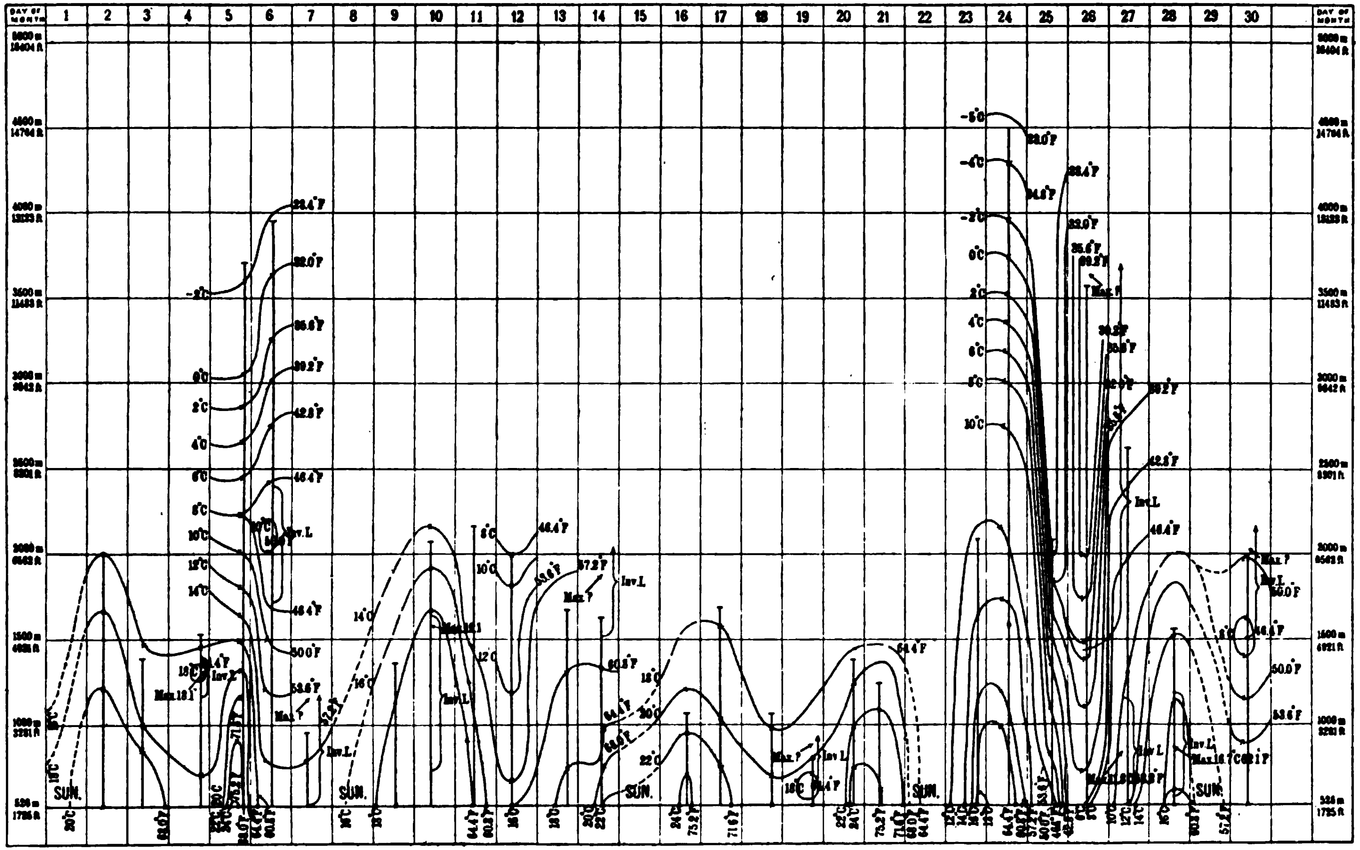
Plate VIII shows the kite field. It is not located on a hilltop but in a saddle, points on either side at distances of half a mile from it along the range being slightly higher. Thru this slight depression in the range there is almost always a sufficient air movement to take the kites into the upper air currents. Nine miles per hour (4.0 meters per second) has been found a sufficient surface current in which to get the kites started, although flights have been obtained in even less wind than this. In a number of directions from the reel house there are sufficient clearings to enable us to take the kites out a distance of



Upper air isotherms, July, 1907.



Upper air isotherms, August, 1907.



Upper air isotherms, September, 1907.

1,000 feet (305 meters) or more when insufficient wind at the surface demands this procedure.

Twice in the last three months the winds have been too light to start kites at any time during the day. On such occasions the kite meteorograph is sent up by means of captive balloons. The balloons used for this purpose are the Assmann rubber balloons generally used in free balloon work. They are about 6 feet (150 to 200 centimeters) in diameter. Two or three of these in tandem are sufficient to carry the meteorograph and 6,000 or 7,000 feet (2,000 meters) of piano wire of diameter .02 inch (.5 millimeter).

Plate IX is an interior view of the power-house, showing the 35-horsepower (26 kilowatts) engine, the 23.5-horsepower (17.5 kilowatts) generator, the electrolyser for the production of the hydrogen used in balloon work, and the Norwalk compressor used in compressing gas for shipment and in making liquid air.

Plate III is an interior view showing in part the office and instrumental equipment of the aerial department. The testing chamber and air pump are central in the illustration.

In the data which follow such of the observations taken at the reel house and aloft as show peculiarities or changes in the temperature gradients or air currents, altitudes of clouds, depths of cloud and fog layers, and the highest points reached have been selected and worked up.

In order to present a general graphical view of the upper air temperatures for the three months, July, August, and September, isothermal charts (I, II, and III, respectively) have been constructed as follows:

From the data as they appear in the tables the temperature gradient as observed by each flight is plotted and from these plots are taken the altitudes for each degree of temperature. These data together with the time of flight are used in the construction of the charts, a given temperature being located at the intersection of the ordinate and abscissa indicating the altitude and time, respectively, at which it was observed.

A sample of the temperature gradient plots is shown in fig. 3. This is the plot for September 5. Altitudes are shown by the ordinates and temperatures by the abscissas. Points transferred from the gradient plots to the isothermal charts are marked (**X**) and connected by means of solid lines.

Dashed lines are used to show the supposed positions of the isotherms on days in which these particular temperatures were not reached. Other interpolations might be made in the upper isotherms

with a high degree of probability. The charts are thus made to show the temperature gradient as actually observed and, in a general way, its continuous changes with altitude and time as well as the upper air temperatures themselves.

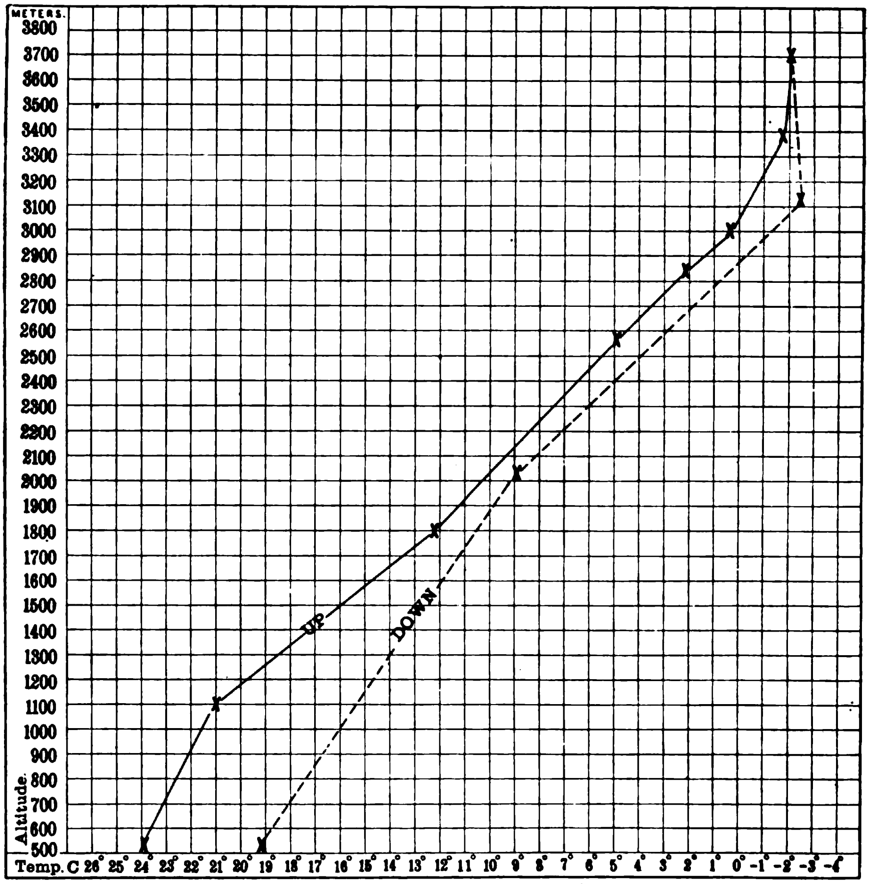


FIG. 3.—Temperature gradient plot, September 5, 1907.

An inversion layer is marked by a brace at the ends of which the temperature is the same but lower than that at any included altitude. This temperature is the lowest reached below the inversion, and its two altitudes form the upper and lower boundaries of the layer. The position of the maximum temperature obtained in the inversion is located on the chart by means of an arrow and the actual temperature at this altitude given.

Actual altitudes obtained are shown by the vertical lines drawn on the chart at the time the highest point of the flight was reached. The mean of the highest altitudes reached daily in these three months is 6,535 feet (1,992 meters) and the highest altitude reached was 14,774 feet (4,503 meters).

The data for the flights made during the month of June are given, but no isothermal chart was made for this month owing to the fact that daily upper air readings were not begun until late in the month.

Further discussion of the following data from other points of view will appear in later numbers of the bulletin.

The numerical results of kite flights follow:

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
June 5, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:57 a. m..	61.0	16.0	74	sw.	12	5.4	1,725	526	61.0	16.0	74	sw.	12	5.4
8:05 a. m...	61.0	16.0	81	s.	14	6.3	2,591	790	59.0	15.0	63	sw.	......	......
8:15 a. m...	61.0	16.0	81	s.	14	6.3	2,638	804	61.0	16.0	65	sw.	......	......
8:20 a. m...	61.5	16.5	75	s.	14	6.3	3,522	1,074	59.0	15.0	45	sw.	......	......
8:37 a. m...	60.5	16.0	75	s.	14	6.3	4,323	1,320	55.0	13.0	45	sw.	......	......
8:48 a. m...	61.0	16.0	70	s.	14	6.3	5,114	1,558	51.5	11.0	65	sw.	......	......
8:55 a. m...	62.0	16.5	68	s.	14	6.3	4,925	1,501	52.0	11.0	70	w.	......	......
9:02 a. m...	62.0	16.5	69	sw.	12	5.4	5,725	1,745	48.0	9.0	75	w.	......	......
9:12 a. m...	61.0	16.0	70	sw.	12	5.4	6,936	2,114	43.0	6.0	85	w.	......	......
9:22 a. m...	61.0	16.0	76	sw.	12	5.4	7,925	2,416	39.0	4.0	95	w.	......	......
9:29 a. m...	61.0	16.0	75	sw.	12	5.4	8,322	2,536	38.5	3.5	100	w.	......	......
10:00 a. m...	60.5	16.0	78	sw.	10	4.5	5.137	1.566	50.0	10.0	94	sw.	......	......
10:17 a. m...	60.5	16.0	81	sw.	7	3.1	1,725	526	60.5	16.0	81	sw.	7	3.1
June 6, 1907.														
1:36 p. m....	64.5	18.1	44	nw.	28	12.5	1,725	526	64.5	18.1	44	nw.	28	12.5
1:39 p. m...	64.0	17.8	45	nw.	28	12.5	2,010	612	56.5	13.6	45	nw.	......	......
1:47 p. m....	63.8	17.7	48	nw.	28	12.5	4,042	1,232	51.5	10.8	50	nw.	......	......
1:57 p. m....	63.6	17.6	49	nw.	28	12.5	4,975	1,516	47.0	8.6	50	nnw	......	......
1:59 p. m....	63.4	17.4	50	nw.	28	12.5	5,248	1,598	45.5	7.5	58	nnw	......	......
2:05 p. m....	63.0	17.2	49	nw.	24	10.7	6,090	1,856	41.5	5.3	64	nnw	......	......
2:08 p. m....	62,8	17.1	48	nw.	24	10.7	6,859	2,090	37.5	3.1	75	w.	......	......
2:11 p. m....	62.6	17.0	47	nw.	24	10.7	7,106	2,166	37.2	2.9	75	w.	......	......
3:10 p. m....	65.0	18.3	44	nw.	25	11.2	8,172	2,491	34.5	1.4	85	w.	......	......
3:35 p. m....	65.0	18.3	40	nw.	25	11.2	8,825	2,690	32.0	0.0	88	w.	......	......
4:16 p. m....	65.8	18.8	37	nw.	25	11.2	5,665	1,726	44.0	6.7	78	wnw	......	......
4:24 p. m....	65.5	18.6	38	nw.	25	11.2	5,237	1,596	46.0	7.8	70	wnw	......	......
4:34 p.m....	65.8	18.8	39	nw.	25	11.2	4,175	1,272	53.0	11.7	60	nw.	......	......
5:07 p.m....	65.0	18.3	38	nw.	25	11.2	1,725	526	65.0	18.3	38	nw.	25	11.2

June 5, 1907.—The flight was made with one kite having a lifting surface of 68 square feet (6.3 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 10,000 feet (3,048 meters).

From 7/10 to 9/10 stratus and strato-cumulus clouds prevailed during the flight. At an altitude of 7,925 feet (2,416 meters) above sea level, the kite was in the clouds.

At the time of the flight the station was about 800 miles due south of a center of decidedly low pressure over the Province of Ontario. A ridge of high pressure was central over the Missouri River Valley, and moderately high pressure prevailed over Florida. Heavy precipitation had previously occurred in Wisconsin.

June 6, 1907.—The flight was made with two kites having a total lifting surface of 112 square feet (10.5 square meters).

At the maximum altitude, the maximum amount of wire, 13,200 feet (4,023 meters) was out.

At the beginning of the flight 3/10 strato-cumulus clouds from the northwest were observed. At an altitude of 7,106 feet (2,166 meters) above sea level the kite was in the base of cumulus clouds. Toward the close of the flight the clouds were dissipating.

At the time of the flight an extensive area of low pressure was central over the upper St. Lawrence Valley, and the station was about midway between this disturbance and an area of high pressure central over Tennessee. Heavy precipitation had previously occurred over the lower Great Lakes.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
June 10, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:31 a. m....	55.0	12.8	70	e.	10	4.5	1,725	526	55.0	12.8	70	e.	10	4.5
7:40 a. m....	55.0	12.8	71	e.	10	4.5	2,619	798	53.0	11.7	70	ene.	......	......
7:48 a. m....	55.0	12.8	71	e.	10	4.5	3,163	964	53.0	11.7	65	e.	......	......
7:58 a. m....	55.0	12.8	70	e.	10	4.5	3,381	1,031	51.7	10.9	65	e.	......	......
8:02 a. m....	55.0	12.8	70	e.	10	4.5	3,646	1,111	51.2	10.7	65	e.	......	......
8:40 a. m....	56.0	13.3	69	e.	9	4.0	4,146	1,264	49.3	9.6	67	e.	......	......
9:26 a. m....	57.0	13.9	71	e.	10	4.5	4,339	1,322	49.2	9.6	67	e.	......	......
9:30 a. m....	58.0	14.4	72	e.	10	4.5	4,165	1,270	49.2	9.6	67	e.	......	......
9:44 a. m....	59.0	15.0	75	e.	10	4.5	1,725	526	59.0	15.0	75	e.	10	4.5
June 15, 1907.														
7:39 a. m...	58.0	14.5	72	nw.	28	12.5	1,725	526	58.0	14.5	72	nw.	28	12.5
7:47 a. m...	57.5	14.2	75	nw.	28	12.5	3,302	1,006	58.0	14.5	60	nw.	......	......
7:58 a. m...	58.2	14.5	72	nw.	27	12.1	4,506	1,374	60.0	15.6	45	nnw	......	......
8:01 a. m...	59.0	15.0	72	nw.	26	11.6	4,515	1,376	60.0	15.6	45	nnw	......	......
8:02 a. m...	60.2	15.7	71	nw.	26	11.6	4,578	1,395	59.5	15.3	45	nnw	......	......
8:11 a. m...	61.3	16.3	71	nw.	26	11.6	5,135	1,565	57.5	14.2	45	nnw	......	......
8:46 a. m...	62.3	16.8	70	nw.	25	11.2	6,867	2,093	49.5	9.7	50	nnw	......	......
9:00 a. m...	63.5	17.5	70	nw.	25	11.2	7,005	2,135	49.0	9.5	50	nnw	......	......
9:32 a. m...	64.8	18.2	69	nw.	24	10.7	8,038	2,450	44.0	6.7	60	w.	......	......
10:00 a. m...	66.8	19.3	65	nw.	24	10.7	5,847	1,782	55.5	13.1	45	nnw	......	......
10:21 a. m...	67.0	19.4	64	nw.	23	10.3	4,133	1,260	62.0	16.7	35	nnw	......	......
10:26 a. m...	67.3	19.6	62	nw.	23	10.3	4,115	1,254	62.0	16.7	35	nnw	......	......
10:30 a. m...	67.5	19.7	60	nw.	22	9.8	3,525	1,074	64.0	17.8	30	nw.	......	......
10:33 a. m...	67.7	19.8	59	nw.	22	9.8	2,925	892	61.0	16.1	35	nw.	......	......
10:41 a. m...	68.0	20.0	57	nw.	21	9.4	1,725	526	68.0	20.0	57	nw.	21	9.4

June 10, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 5,000 feet (1,524 meters); wire out at maximum altitude was 5,000 feet (1,524 meters).

About 8/10 clouds, of a cumulus nature, observed at beginning of flight, gradually diminished toward the close.

At the time of the flight a barometric depression of considerable intensity was central over Iowa and southern Minnesota, accompanied by thunderstorms and heavy precipitation. An area of high pressure was central over the St. Lawrence Valley.

June 15, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 10,000 feet (3,048 meters).

From 1/10 to 5/10 alto-cumulus and strato-cumulus clouds prevailed during the flight.

At the time of the flight an extensive area of high pressure, central over the middle Mississippi Valley, dominated the weather over the central part of the United States. An area of low pressure was central off the coast of Massachusetts.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
June 20, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:50 a. m...	68.0	20.0	....	w.	18	5.8	1,725	526	68.0	20.0	.....	w.	18	5.8
8:50 a. m...	70.0	21.1	....	w.	12	5.4	2,486	758	70.0	21.1	.....	w.	......	......
9:24 a. m...	71.5	21.9	....	w.	10	4.5	1,725	526	71.5	21.9	.....	w.	10	4.5
June 22, 1907.														
1:45 p. m...	80.0	26.7	56	se.	12	5.4	1,725	526	80.0	26.7	56	se.	12	5.4
2:57 p. m...	79.0	26.1	....	se.	12	5.4	3,967	1,209	70.0	21.1	.....	se.	......	......
3:31 p. m...	80.0	26.7	56	se.	12	5.4	1,725	526	80.0	26.7	56	se.	12	5.4
June 24, 1906.														
2:34 p. m...	78.0	25.6	....	sse.	12	5.4	1,725	526	78.0	25.6	....	sse.	12	5.4
2:49 p. m...	78.5	25.8	....	sse.	12	5.4	3,134	955	73.1	22.8	.....	sse.	......	......
3:08 p. m...	79.0	26.1	....	se.	13	5.8	4,203	1,281	67.5	19.7	.....	sse.	......	......
3:46 p. m...	80.0	26.7	....	se.	14	6.3	1,725	526	80.0	26.7	.....	se.	14	6.3

June 20, 1907.—The flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum amount of wire out was 1,800 feet (549 meters); wire out at maximum altitude was 1,800 feet (549 meters).

The sky was totally obscured by alto-stratus and alto-cumulus clouds during the flight.

At the time of the flight the Middle and South Atlantic States were covered by moderately high pressure, with centers over northern Georgia and over the lower Lakes. A low pressure area was moving in over Montana from the northwest. Heavy precipitation had previously occurred in Vermont.

June 22, 1907.—The flight was made with two kites having a total lifting surface of 142 square feet (13.1 square meters).

The maximum amount of wire out was 3,500 feet (1,067 meters); wire out at maximum altitude was 3,500 feet (1,067 meters).

A generally hazy atmosphere prevailed at beginning of the flight, and from 1/10 to 3/10 clouds, of a cumulus nature, were visible thruout the flight.

At the time of the flight high pressure dominated the weather over the eastern half of the country, while a barometric depression of considerable intensity prevailed over the western half, being central over Utah. The station was between two centers of the eastern high.

June 24, 1907.—The flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum amount of wire out was 5,000 feet (1,524 meters); wire out at maximum altitude was 4,000 feet (1,219 meters).

From 1/10 to 3/10 alto-cumulus clouds and a few cumulus were visible during the flight.

At the time of the flight the entire southeastern part of the United States was covered by moderately high pressure. A trough of low pressure extended from Mexico to Minnesota, and an area of relatively low pressure was central over the lower St. Lawrence Valley. Heavy precipitation had previously occurred in Virginia.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
June 25, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:20 a. m....	70.0	21.1	....	wnw.	14	6.3	1,725	526	70.0	21.1	....	wnw.	14	6.3
7:46 a. m....	71.0	21.7	....	wnw.	14	6.3	3,761	1,146	67.3	19.6	.....	w.	......	......
8:49 a. m....	73.5	23.1	....	nw.	13	5.8	1,725	526	73.5	23.1	.....	nw.	13	5.8
June 26, 1907.														
7:18 a. m....	70.0	21.1	....	w.	21	9.4	1,725	526	70.0	21.1	....	w.	21	9.4
7:30 a. m. ..	70.2	21.2	....	w.	21	9.4	2,553	778	68.4	20.2	.....	wnw	......	......
8:21 a. m....	72.8	22.7	....	w.	21	9.4	3,451	1,052	70.0	21.1	.....	w.	......	......
8:50 a. m....	73.0	22.8	....	w.	20	8.9	5,266	1,605	59.2	15.1	.....	w.	......	......
9:20 a. m....	73.5	23.1	....	w.	20	8.9	10,679	3,255	41.7	5.4	.....	wsw	......	......
9:28 a. m....	73.2	22.9	71	nw.	20	8.9	11,207	3,416	38.1	3.4	.....	wsw	......	......
9:58 a. m....	73.0	22.8	76	nw.	16	7.2	13,458	4,102	30.4	—0.9	.....	wsw	......	......
1:06 p. m....	72.0	22.2	82	w.	13	5.8	1,725	526	72.0	22.2	82	w.	13	5.8

June 25, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 3,800 feet (1,158 meters); wire out at maximum altitude was 3,500 feet (1,067 meters).

About 1/10 alto-culumus clouds from the southwest, observed at the beginning of the flight, gradually increased to 3/10 toward the close.

At the time of the flight the South Atlantic States were covered by an area of high pressure central over northern Georgia. A trough of moderately low pressure extended from Mexico northeastward to the St. Lawrence Valley, with a center over eastern Kansas and another north of the lower Lakes.

June 26, 1907.—The flight was made with four kites having a total lifting surface of 272 square feet (25.2 square meters).

The maximum amount of wire out was 19,000 feet (5,791 meters); wire out at maximum altitude was 19,000 feet (5,791 meters).

At beginning of the flight about 3/10 strato-cumulus and 4/10 alto-stratus clouds, from the west, were observed. At 8:50 a. m. the clouds were increasing and when the uppermost kite had reached an altitude of 10,679 feet (3,255 meters), it was in the base of them. At 10:24 a. m. a light shower began and heavy rain was approaching in the valley to the west; this reached the station, accompanied by strong wind, about 11:55 a. m.

At the time of the flight the station was to the south of an area of low pressure, accompanied by showers and thunderstorms, central over the upper St. Lawrence Valley. An extensive high, central over Wyoming and South Dakota, dominated weather conditions over the western half of the country. Heavy precipitation had previously occurred in Florida and Arkansas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
June 27, 1907.	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*
7:26 a. m...	61.8	16.6	....	nw.	19	8.5	1,725	526	61.8	16.6	.....	nw.	19	8.5
7:38 a. m...	62.5	16.9	....	nw.	19	8.5	3,652	1,113	53.7	12.1	.....	wnw.	.....	......
7:56 a. m...	62.5	16.9	....	nw.	19	8.5	5,361	1,634	49.2	9.6	.....	wnw.	.....	......
8:31 a. m...	63.8	17.7	....	nw.	21	9.4	8,125	2,477	52.8	11.6	.....	wnw.	......	......
8:56 a. m...	64.0	17.8	....	nw.	21	9.4	8,982	2,738	47.4	8.6	.....	wnw.	......	......
June 28, 1907.														
10:23 a. m...	70.0	21.1	....	e.	10	4.5	1,725	526	70.0	21.1	.....	e.	10	4.5
10:39 a. m...	71.0	21.7	....	se.	10	4.5	3,346	1,020	68.0	20.0	.....	sse.	......	......
10:54 a. m...	71.0	21.7	....	se.	10	4.5	3,402	1,037	65.5	18.6	.....	sse.	......	......
11:12 a. m...	72.0	22.2	....	se.	11	4.9	4,029	1,228	63.7	17.6	.....	sse.	......	......
11:31 a. m...	72.0	22.2	....	se.	11	4.9	1,725	526	72.0	22.2	.....	se.	11	4.9
June 29, 1907.														
8:07 a. m...	56.0	13.3	....	e.	15	6.7	1,725	526	56.0	13.3	.....	e.	15	6.7
8:34 a. m...	56.0	13.3	....	e.	15	6.7	3,908	1,191	59.7	15.4	.....	ese.	......	......
8:44 a. m...	56.0	13.3	....	e.	15	6.7	2,600	792	56.0	13.3	.....	ese.	......	......
8:54 a. m...	55.5	13.1	....	e.	16	7.2	1,725	526	55.5	13.1	.....	e.	16	7.2

June 27, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 15,000 feet (4,572 meters); wire out at maximum altitude was 15,000 feet (4,572 meters).

About 8/10 clouds were observed at beginning; these gradually diminished to 5/10 near close of the flight.

At the time of the flight the weather over the entire central portion of the United States was dominated by a high, central over Nebraska. An extensive area of low pressure was central over eastern Maine and a secondary low, central over South Carolina. Heavy precipitation had accompanied both depressions.

June 28, 1907.—The flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum of wire out was 4,500 feet (1,372 meters); wire out at maximum altitude was 4,000 feet (1,219 meters).

About 8/10 stratus clouds at beginning of flight gradually diminished to 5/10 toward the close.

At the time of the flight a depression of considerable intensity was moving off over the lower St. Lawrence Valley, and a secondary low was central over Mississippi, while moderately high pressure centered over the lower Great Lakes. Heavy precipitation had previously occurred in Georgia.

June 29, 1907.—The flight was made with one kite having a lifting surface of 68 square feet (6.3 square meters).

The maximum of wire out was 4,085 feet (1,245 meters); wire out at maximum altitude was 3,100 feet (945 meters).

A dense fog prevailed during the flight.

At the time of the flight the station was near the center of an area of low pressure covering the Atlantic coast. An area of moderately high pressure was central over Nova Scotia and another over Arkansas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 1, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
10:32 a. m...	74.0	23.8	..	sse	11	4.9	1,725	526	74.0	23.3	.....	sse	11	4.9
10:58 a. m...	74.4	23.6	....	s.	12	5.4	2,899	883	70.0	21.1	.....	s.	......	....
11:19 a. m...	75.0	23.9	...	s.	12	5.4	1,725	526	75.0	23.9	.....	s.	12	5.4
2d flight.														
1:24 p. m...	77.5	25.3	61	s.	15	6.7	1,725	526	77.5	25.8	61	s.	15	6.7
3:14 p. m...	78.0	25.6	62	s.	16	7.2	5,025	1,532	64.9	18.3	.....	ssw	......	......
3:42 p. m...	78.0	25.6	64	s.	16	7.2	1,725	526	78.0	25.6	64	s.	16	7.2
July 2, 1907.														
7:13 a. m....	66.4	19.1	87	nw.	26	11.6	1,725	526	66.4	19.1	87	nw.	26	11.6
7:20 a. m....	86.4	19.1	87	nw.	26	11.6	3,689	1,124	65.0	18.8	.....	nw.	......	.....
7:36 a. m....	66.6	19.2	86	nw.	26	11.6	6,067	1,849	58.0	14.4	.....	nw.	......	......
8 00 a. m....	68.0	20.0	85	nw.	26	11.6	6,478	1,974	56.5	13.6	.....	nw.	......	......
8:07 a. m....	68.5	20.3	85	nw.	25	11.2	5,881	1,792	57.5	14.2	.....	nw.	......	......
8:17 a. m....	69.0	20.6	86	nw.	25	11.2	5,065	1,544	60.2	15.6	.....	nw.	......	......
8:29 a. m....	70.0	21.1	81	nw.	25	11.2	4,014	1,224	61.5	16.4	.....	nw.	......	...
8:41 a. m....	70.0	21.1	81	nw.	23	10.3	3,045	928	62.5	16.9	.....	nw.	......	......
8:56 a. m....	70.5	21.4	79	nw.	20	8.9	1,725	526	70.5	21.4	79	nw.	20	8.9

July 1, 1907.—The first flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum amount of wire out was 1,770 feet (540 meters); wire out at maximum altitude was 1,400 feet (427 meters).

The second flight was made with three kites having a total lifting surface of 204 square feet (18.9 square meters).

The maximum amount of wire out was 7,890 feet (2,405 meters); wire out at maximum altitude was 7,000 feet (2,134 meters).

A few cumulus clouds, drifting from the south, were observed at the beginning of the flight. At 2:55 p. m. the cumulus clouds had disappeared and a few cirrus were observed in the northwest.

At the time of the flights the station was on the southeastern border of a trough of low pressure extending from Texas northeastward into Canada. An area of high pressure was central over Yellowstone Park, Wyo., and another over the Florida Peninsula.

July 2, 1907.—The flight was made with one kite having a lifting surface of 68 square feet (6.3 square meters).

The maximum amount of wire out was 9,100 feet (2,774 meters); wire out at maximum altitude was 8,000 feet (2,438 meters).

A few small cumulus and alto-stratus clouds were observed at the beginning of the flight. Detached cumulus clouds past under kite at an altitude of 6,400 feet (1,951 meters). Cumulus and alto-stratus were increasing during the flight.

At the time of the flight the station was in the southern portion of an area of low pressure central over the St. Lawrence Valley. The pressure was high over the upper Lake region.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m., 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 3, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:17 a. m.	56.8	13.8	83	nw.	19	8.5	1,725	526	56.8	13.8	83	nw.	19	8.5
7:22 a. m.	57.3	14.1	81	nw.	19	8.5	3,332	1,016	47.2	8.5	90	n.	......	......
7:38 a. m.	57.8	14.3	80	nw.	19	8.5	3,843	1,172	58.0	14.5	60	n.	......	......
7:54 a. m.	58.0	14.5	80	nw.	19	8.5	5,989	1,826	55.5	13.1	40	nnw	......	......
8:45 a. m.	60.0	15.6	77	nw.	18	8.0	6,432	1,961	53.5	12.0	45	nnw	......	......
10:06 a. m.	62.0	16.7	73	nw.	21	9.4	5,985	1,825	55.5	13.1	40	n.	......	......
10:30 a. m.	62.5	16.9	70	nw.	23	10.3	3,975	1,212	60.8	16.0	40	n.	......	......
10:36 a. m.	63.5	17.5	70	nw.	23	10.3	3,821	1,165	56.0	13.3	45	n.	......	......
10:43 a. m.	63.5	17.5	70	nw.	23	10.3	2,555	779	55.0	12.8	65	nw.	......	......
10:50 a. m.	63.5	17.5	70	nw.	23	10.3	1,725	526	63.5	17.5	70	nw.	23	10.3
July 4, 1907.														
5:19 p. m.	69.0	20.6	64	se.	9	4.0	1,725	526	69.0	20.6	64	se.	9	4.0
5:49 p. m.	68.0	20.0	67	se.	10	4.5	3,621	1,104	61.2	16.2	68	se.	......	......
6:25 p. m.	68.0	20.0	65	se.	8	3.6	1,725	526	68.0	20.0	65	se.	8	3.6
July 5, 1907.														
4:26 p. m.	69.4	20.8	70	w.	10	4.5	1,725	526	69.4	20.8	70	w.	10	4.5
5:08 p. m.	71.0	21.7	64	w.	9	4.0	2,763	842	65.0	18.3	60	......	......	......
5:28 p. m.	72.5	22.5	63	w.	9	4.0	1,725	526	72.5	22.5	63	w.	9	4.0

July 3, 1907.—The flight was made with three kites having a total lifting surface of 204 square feet (18.9 square meters).

The altitude of the flight was limited by the decreased velocity of the upper wind.

The maximum amount of wire out was 10,500 feet (3,200 meters); wire out at maximum altitude was 10,000 feet (3,048 meters).

At the beginning of the flight there were only a few low clouds traveling from the north-northwest. At the close of the flight the clouds had increased to 4/10 strato-cumulus.

At the time of the flight the station was in the eastern part of an area of high pressure central over Indiana. The nearest area of low pressure was central over Georgia while another prevailed over Maine.

July 4, 1907.—The flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum amount of wire out was 3,700 feet (1,128 meters); wire out at maximum altitude was 3,500 feet (1,067 meters).

The sky was totally obscured by strato-cumulus clouds during flight.

At the time of the flight the station was near the center of an extensive area of high pressure covering the Ohio Valley. A barometric depression of considerable intensity was moving in over Montana and the Dakotas from the northwest.

July 5, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 3,000 feet (914 meters); wire out at maximum altitude was 2,500 feet (762 meters).

During the flight the sky was totally obscured by cumulus and strato-cumulus clouds.

At the time of the flight the station was the center of an extensive area of high pressure covering the entire portion of the United States east of the Mississippi River, except the upper Lake region. A barometric depression of considerable intensity, accompanied by thunderstorms, was central over southern Minnesota.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 6, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
5:27 p. m. ..	78.0	25.6	64	s.	11	4.9	1,725	526	78.0	25.6	64	s.	11	4.9
6:05 p. m....	77.0	25.0	65	s.	12	5.4	4,178	1,272	68.8	20.4	.....	sse.	......	......
6:25 p. m....	76.8	24.9	65	s.	12	5.4	1,725	526	76.8	24.9	65	s.	12	5.4
July 8, 1907.														
2:04 p. m....	84.0	28.9	....	w.	12	5.4	1,725	526	84.0	28.9	.....	w.	12	5.4
2:50 p. m....	84.4	29.1	....	w.	12	5.4	6,127	1,868	61.9	16.6	.....	w.	......	.....
3:20 p. m....	85.5	29.7	....	nw.	13	5.8	8,692	2,650	52.2	11.2	.....	w.	......	......
3:40 p. m....	85.5	29.7	....	nw.	14	6.3	6,842	2,086	59.2	15.1	.....	w.	......	......
4:02 p. m....	85.3	29.6	....	nw.	15	6.7	4,800	1,463	69.1	20.6	.....	w.	......	.....
4:27 p. m....	84.9	29.4	....	nw.	15	6.7	1,725	526	84.9	29.4	.....	nw.	15	6.7
July 9, 1907.														
9:27 a. m ..	71.5	21.9	....	nw.	24	10.7	1,725	526	71.5	21.9	.....	nw.	24	10.7
8:40 a. m...	72.4	22.4	....	w.	20	8.9	4,028	1,228	67.1	19.5	.....	wnw	......	......
10:10 a. m...	72.7	22.6	....	nw.	28	12.5	5,562	1,695	63.0	17.2	.....	wnw	......	......
10:37 a. m...	73.8	23.2	....	nw.	30	13.4	6,580	2,006	60.3	15.7	.....	wnw	......	......
11:47 a. m...	71.6	22.0	....	w.	35	15.6	1,725	526	71.6	22.0	.....	w.	35	15.6

July 6, 1907.—The flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum amount of wire out was 4,680 feet (1,426 meters); wire out at maximum altitude was 4,000 feet (1,219 meters).

At the beginning of the flight about 1/10 stratus and strato-cumulus clouds were observed, gradually diminishing toward the end of flight.

At the time of the flight the station was in the southern border of an area of low pressure central over Lake Erie, while to the south an extensive area of moderately high pressure prevailed over the Gulf States.

July 8, 1907.—The flight was made with two kites having a total lifting surface of 224 square feet (21 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 10,000 feet (3,048 meters).

From two to three-tenths cumulus clouds prevailed during the flight.

At the time of the flight the station was midway between an extensive area of low pressure central over White River, Canada, and an extensive high central over northwestern Georgia. Thunderstorms prevailed over the upper Lake region and northern New England, accompanied by excessive precipitation in the latter region.

July 9, 1907.—The flight was made with one kite having a lifting surface of 68 square feet (6.3 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 10,000 feet (3,048 meters).

Clouds at beginning of flight, 2/10 strato-cumulus from the northwest, gradually increasing to total cloudiness. Elevation of clouds: 3,500 to 4,000 feet (1,067 to 1,219 meters).

At the time of the flight the station bordered on the edge of an extensive barometric depression central over Quebec. A moderate high of considerable extent prevailed over the South Atlantic and Gulf States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 10, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
9:55 a. m...	75.8	24.3	.....	w.	13	5.8	1,725	526	75.8	24.3	.....	wnw	13	5.8
10:33 a. m...	75.7	24.3	.....	w.	10	4.5	4,096	1,248	66.8	19.3	.....	w.	......	......
12:00 m.....	77.0	25.0	.....	w.	11	4.9	1,725	526	77.8	25.0	.....	w.	11	4.9
July 11, 1907.														
7:22 a. m...	68.8	20.4	89	w.	15	6.7	1,725	526	68.8	20.4	89	w.	15	6.7
7:55 a. m...	69.2	20.7	82	w.	11	4.9	5,050	1,539	64.6	18.1	.....	w.	......	......
8:05 a. m...	69.5	20.8	83	w.	10	4.5	5,814	1,772	63.0	17.2	.....	w.	......	......
8:30 a. m...	70.7	21.5	77	w.	10	4.5	7,022	2,140	60.5	15.8	.....	sw.	......	......
9:10 a. m...	75.5	24.2	66	sw.	8	3.6	8,923	2,720	50.5	10.3	.....	sw.	......	......
10:20 a. m...	78.0	25.6	67	s.	8	3.6	11,934	3,638	37.9	3.3	.....	w.	......	......
12:05 p. m...	79.0	26.1	68	s.	10	4.5	10,249	3,124	46.0	7.8	.....	w.	......	......
12:31 p. m...	79.5	26.4	68	s.	10	4.5	7,480	2,280	55.3	12.9	.....	sw.	......	......
1:00 p. m...	79.8	26.6	70	s.	9	4.0	1,725	526	79.8	26.6	70	s.	9	4.0

July 10, 1907.—The flight was made with two kites having a total lifting surface of 142 square feet (13.1 square meters).

The maximum amount of wire out was 4,000 feet (1,219 meters); wire out at maximum altitude was 4,000 feet (1,219 meters).

Clouds at beginning of flight, 4/10 alto-cumulus, from the west-northwest. Toward the end of the flight cumulo-nimbus clouds appeared over the Shenandoah Valley, thunder was heard, and rain soon began.

At the time of the flight a trough of low pressure extended from New Mexico to the Gulf of St. Lawrence, while the Gulf States were covered by a moderate high.

July 11, 1907.—The flight was made with two kites having a total lifting surface of 142 square feet (13.1 square meters).

The maximum amount of wire out was 18,750 feet (5,715 meters); wire out at maximum altitude was 18,750 feet (5,715 meters).

At the beginning of the flight 9/10 strato-cumulus clouds were observed but later diminished to 2/10 cumulus and 4/10 alto-cumulus toward end of flight. Kite entered cloud base at an elevation of 10,000 feet (3,048 meters).

At the time of the flight the station was in the front portion of a trough of low pressure extending from Texas northeastward into the St. Lawrence Valley, with well-defined areas of high pressure on either side. Thunderstorms were general thruout the entire portion of the United States east of the Rocky Mountains.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 12, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
8:00 a. m.	70.2	21.2	86	w.	16	7.2	1,725	526	70.2	21.2	86	w.	16	7.2
8:16 a. m.	70.2	21.2	86	w.	18	8.0	4,175	1,273	61.8	16.3	.....	w.	.....	.....
8:34 a. m.	70.5	21.4	86	w.	20	8.9	5,635	1,718	58.0	14.4	.....	w.	.....	.....
8:55 a. m.	70.0	21.1	86	w.	14	6.3	6,335	1,931	56.0	13.3	.....	w.	.....	.....
9:16 a. m.	70.4	21.3	83	w.	13	5.8	4,945	1,507	58.3	14.6	.....	w.	.....	.....
9:36 a. m.	72.0	22.2	82	w.	13	5.8	1,725	526	72.0	22.2	82	w.	13	5.8
July 13, 1907.														
6:50 p. m.	69.0	20.1	....	se.	9	4.0	1,725	526	69.0	20.1	.....	se.	9	4.0
7:38 p. m.	66.0	18.9	....	se.	8	3.6	3,110	948	61.5	16.4	.....	se.	.....	.....
8:05 p. m.	68.0	20.0	....	se.	8	3.6	1,725	526	68.0	20.0	.....	se.	8	3.6
July 15, 1907.														
7:41 a. m.	63.0	17.2	98	se.	10	4.5	1,725	526	63.0	17.2	98	se.	10	4.5
9:53 a. m.	70.0	21.1	79	se.	12	5.4	3,031	924	65.6	18.7	.....	se.	.....	.....
10:07 a. m.	71.0	21.7	79	se.	13	5.8	1,725	526	71.0	21.7	79	se.	13	5.8

July 12, 1907.—The flight was made with one kite having a lifting surface of 68 square feet (6.3 square meters).

The maximum amount of wire out was 7,000 feet (2,134 meters); wire out at maximum altitude was 7,000 feet (2,134 meters).

At the beginning of the flight the sky was entirely overcast with stratus clouds moving from the west. Showers began at 8:55 a. m., and continued intermittently thruout the flight.

At the time of the flight the station was in the southern portion of a well-developed area of low pressure central over northern New York, accompanied by considerable cloudiness and rain. Heavy precipitation had occurred during the previous twenty-four hours in the Ohio and lower Mississippi valleys and the lower Lake region. An area of moderately high pressure was central over eastern Kansas and another over the Florida Peninsula.

July 13, 1907.—The flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum amount of wire out was 3,000 feet (914 meters); wire out at maximum altitude was 2,250 feet (686 meters).

During the flight about 6/10 alto-stratus and alto-cumulus clouds were observed moving from the west.

At the time of the flight an area of low pressure was central over New Brunswick, while an extensive area of moderately high pressure, central over Ohio and Florida, dominated the weather south of the Great Lakes and east of the Mississippi River.

July 15, 1907.—The flight was made with two kites having a total lifting surface of 142 square feet (13.1 square meters).

The maximum amount of wire out was 4,000 feet (1,219 meters); wire out at maximum altitude was 2,500 feet (762 meters).

Dense fog in the early morning. Light fog at the beginning of the flight, gradually dissipating. At 8:45 a. m. the fog had lifted and 10/10 stratus clouds were observed moving from the southeast. The clouds diminished toward the end of the flight to about 4/10 strato-cumulus, from the southeast.

At the time of the flight the station bordered on the edge of a high pressure area central over eastern Maine, while a well-developed low, accompanied by thunderstorms, was central over Manitoba.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 16, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
3:34 p. m.	82.0	27.8	....	s.	13	5.8	1,725	526	82.0	27.8	.....	s.	13	5.8
4:02 p. m.	82.0	27.8	....	se.	13	5.8	3,461	1,055	72.9	22.7	.....	s.	......	......
4:16 p. m.	82.5	28.1	....	s.	14	6.3	3,457	1,054	72.9	22.7	.....	s.	......	......
4:30 p. m.	82.0	27.8	....	s.	14	6.3	3,815	1,163	70.6	21.4	.....	s.	......	......
4:48 p. m.	81.5	27.5	....	s.	14	6.3	1,725	526	81.5	27.5	.....	s.	14	6.3
July 17, 1907.														
10:31 a. m.	69.5	20.8	....	w.	16	7.2	1,725	526	69.5	20.8	.....	w.	16	7.2
10:43 a. m.	69.8	21.0	....	w.	16	7.2	4,882	1,488	60.0	15.6	.....	w.	......	......
11:01 a. m.	70.0	21.1	....	w.	18	8.0	5,829	1,777	57.3	14.1	.....	w.	......	......
11:03 a. m.	70.0	21.1	....	w.	18	8.0	5,925	1,806	58.2	14.6	.....	w.	......	......
11:09 a. m.	70.6	21.4	....	sw.	18	8.0	5,970	1,820	59.1	15.1	.....	w.	......	......
11:45 a. m.	71.0	21.7	....	sw.	20	8.9	5,925	1,806	60.9	16.1	.....	w.	......	......
12:12 p. m.	71.0	21.7	....	w.	23	10.3	1,725	526	71.0	21.7	.....	w.	23	10.3

July 16, 1907.—The flight was made with one kite having a lifting surface of 121 square feet (11.2 square meters).

The maximum amount of wire out was 3,900 feet (1,189 meters); wire out at maximum altitude was 3,000 feet (914 meters).

At the beginning of the flight the sky was partially obscured by 3/10 cumulus from the south and 1/10 alto-cumulus from the northwest. One-half hour later 1/10 cumulus from the south and 4/10 alto-cumulus from the northwest were observed, but the tendency was toward clearing at the end of the flight.

This flight occurred in the middle of the afternoon. A trough of low pressure extended from western Texas up the Mississippi Valley into Canada, with a secondary depression to the north of Lake Ontario. A moderate high predominated the Atlantic and Gulf states from Maine to Louisiana.

July 17, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 10,900 feet (3,322 meters); wire out at maximum altitude was 6,500 feet (1,981 meters).

At the beginning of the flight occasional thunder was heard and light rain was falling. At 11:25 a. m. rain ceased. Clouds were moving from the southwest.

At the time of the flight high pressure prevailed generally in all districts, except from the Lake region eastward, which was dominated by a low, central over the St. Lawrence Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
July 18, 1907.														
7:19 a. m...	72.0	22.2	....	nw.	15	6.7	1,725	526	72.0	22.2	.....	nw.	15	6.7
7:33 a. m...	72.7	22.6	....	nw.	15	6.7	3,434	1,047	71.1	21.7	.....	nw.	......	......
8:00 a. m...	74.0	23.3	....	nw.	16	7.2	4,939	1,506	69.3	20.7	.....	w.	......	......
9:16 a. m...	77.3	25.1	....	nw.	15	6.7	6,216	1,895	62.5	16.9	.....	w.	......	......
9:43 a. m...	77.2	25.2	....	nw.	14	6.3	7,489	2,283	57.6	14.2	.....	w.	......	......
10:18 a. m...	78.5	25.8	....	nw.	14	6.3	1,725	526	78.5	25.8	.....	nw.	14	6.3
July 19, 1907.														
7:20 a. m...	69.0	20.6	....	nw.	10	4.5	1,725	526	69.0	20.6	.....	nw.	10	4.5
8:24 a. m...	72.0	22.2	....	nw.	10	4.5	3,584	1,092	67.0	19.4	.....	ne.	.....	......
9:06 a. m...	74.0	23.3	....	nne.	8	3.6	1,725	526	74.0	23.3	.....	nne.	8	3.6
July 20, 1907.														
9:00 a. m...	69.0	20.6	....	w.	13	5.8	1,725	526	69.0	20.6	.....	w.	13	5.8
9:19 a. m...	70.0	21.1	....	w.	13	5.8	4,065	1,239	62.7	17.1	.....	wnw	......	......
9:38 a. m...	71.0	21.7	....	nw.	11	4.9	5,404	1,647	60.4	15.8	.....	wnw	......	......
10:10 a. m...	73.0	22.8	....	nw.	12	5.4	7,839	2,389	53.5	11.9	.....	w.	......	......
10:35 a. m...	75.2	24.0	....	nw.	11	4.9	8,698	2,650	53.7	12.1	.....	wsw.	......	......
10:45 a. m...	75.5	24.2	....	nw.	12	5.4	8,181	2,494	53.7	12.1	.....	wsw.	......	......
10:48 a. m...	75.5	24.2	....	nw.	12	5.4	8,332	2,540	51.0	10.6	.....	wsw.	......	......
11:01 a. m...	73.7	23.2	....	nw.	12	5.4	6,621	2,018	56.4	13.6	.....	w.	......	......
11:32 a. m...	75.0	23.9	....	nw.	12	5.4	1,725	526	75.0	23.9	.....	nw.	12	5.4

July 18, 1907.—The flight was made with three kites having a total lifting surface of 210 square feet (19.4 square meters).

The maximum amount of wire out was 11,000 feet (3,353 meters); wire out at maximum altitude was 9,000 feet (2,743 meters).

During the flight the sky was partly cloudy, with alto-cumulus from the west. Above a level of 3,000 feet (914 meters) the kites indicated a northwest wind; below this level a thin stratum of very weak wind.

At the time of the flight the station was midway between a low of moderate intensity, central over the St. Lawrence Valley, and an extensive area of high pressure covering the territory south of the Great Lakes and east of the Mississippi River.

July 19, 1907.—The flight was made with two kites having a total lifting surface of 189 square feet (17.5 square meters).

The maximum amount of wire out was 4,000 feet (1,219 meters).

Light fog was observed during the early morning, but disappeared shortly before kite flight. During the flight the lower clouds increased gradually to 8/10 stratus from the north.

At the time of the flight a high of moderate intensity was central about 250 miles (400 kilometers) north of the station. A second high dominated the weather of the Gulf States, while a well-defined low, accompanied by thunderstorms, prevailed over the upper Lake region.

July 20, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 13,500 feet (4,115 meters); wire out at maximum altitude was 13,500 feet (4,115 meters).

At the beginning of the flight rain was falling, but stopped soon thereafter. At 10:25 a. m. low clouds past beneath lowermost kite at an elevation of 3,822 feet (1,165 meters).

At the time of the flight the station was directly south of a well-defined low, central over the St. Lawrence Valley. An extensive area of high pressure dominated the weather of the Mississippi Valley and Gulf States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 22, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
10:36 a. m..	72.4	22.4	78	s.	14	6.3	1,725	526	72.4	22.4	78	s.	14	6.3
10:40 a. m...	72.4	22.4	78	s.	14	6.3	2,260	689	69.7	20.9	78	s.	......	......
11:10 a. m...	73.0	22.8	75	s.	13	5.8	3,902	1,189	68.9	20.5	75	w.	......	......
11:25 a. m...	73.0	22.8	75	s.	12	5.4	6,158	1,877	61.8	16.6	68	w.	......	......
12:00 m.	74.0	23.3	70	......	10	4.5	8,975	2,736	53.8	12.1	68	w.	......	......
12:22 p. m...	74.3	23.5	70	......	9	4.0	11,065	3,373	42.7	5.9	68	w.	......	......
2:20 p. m...	78.0	25.6	70	......	9	4.0	11,749	3,581	39.0	3.9	90	wnw.	......	......
4:20 p. m...	73.6	23.1	70	nw.	7	3.1	13,215	4,028	43.2	6.2	60	nw.	......	......
5:27 p. m...	79.5	26.4	73	nw.	7	3.1	10,176	3,102	50.9	10.5	87	nw.	......	......
5:50 p. m...	79.3	26.3	75	nw.	7	3.1	5,942	1,811	62.5	16.9	88	w.	......	......
6:07 p. m...	79.0	26.1	75	nw.	6	2.7	1,725	526	79.0	26.1	75	nw.	6	2.7
July 23, 1907.														
8:02 a. m...	72.5	22.5	78	nw.	18	8.0	1,725	526	72.5	22.5	78	nw.	18	8.0
8:07 a. m...	73.0	22.8	78	nw.	20	8.9	3,225	983	66.0	18.9	85	nw.	......	......
8:13 a. m...	73.0	22.8	78	nw.	22	9.8	4,012	1,223	63.6	17.0	78	nw.	......	......
8:30 a. m...	73.0	22.8	76	nw.	25	11.2	4,972	1,515	60.1	15.6	75	nw.	......	......
8:49 a. m...	73.0	22.8	73	nw.	23	10.3	7,481	2,280	58.0	14.4	35	nw.	......	......
9:13 a. m...	74.0	23.3	74	nw.	21	9.4	8,690	2,649	54.8	12.7	28	nw.	......	......
9:43 a. m...	74.0	23.3	72	nw.	21	9.4	10,252	3,125	51.4	10.8	.....	wnw.	......	......
10:37 a. m...	75.5	24.0	70	nw.	22	9.8	13,125	4,000	39.2	4.0	.....	w.	......	......
11:38 a. m...	77.0	25.0	64	nw.	18	8.0	12,481	3,804	42.1	5.6	.....	w.	......	......
12:40 p. m...	78.6	25.9	60	nw.	15	6.7	9,614	2,930	52.2	11.2	.....	nw.	......	......
12:57 p. m...	79.0	26.1	60	nw.	16	7.2	8,911	2,716	55.1	12.8	.....	nw.	......	......
1:37 p. m...	79.0	26.1	60	nw.	18	8.0	9,312	2,838	53.2	11.8	.....	nw.	......	......
1:41 p. m...	79.0	26.1	60	nw.	18	8.0	8,951	2,728	53.9	12.2	.....	nw.	......	......
1:47 p. m...	79.0	26.1	60	nw.	17	7.6	8,282	2,524	50.0	10.0	.....	nw.	......	......
2:05 p. m...	78.0	25.6	60	nw.	17	7.6	9,210	2,807	50.6	10.3	50	nw.	......	......
2:30 p. m...	77.5	25.3	62	nw.	16	7.2	7,755	2,364	51.2	10.7	83	nw.	......	......
2:42 p. m...	77.0	25.0	63	nw.	14	6.3	7,689	2,344	51.2	10.7	88	nw.	......	......
2:51 p. m...	77.0	25.0	60	nw.	13	5.8	6,599	2,011	52.2	11.2	95	nw.	......	......
3:19 p. m...	77.5	25.3	65	nw.	14	6.3	1,725	526	77.5	25.3	65	nw.	14	6.3

July 22, 1907.—The flight was made with three kites having a total lifting surface of 210 square feet (19.4 square meters).

The maximum altitude was reached with 19,550 feet (5,959 meters) of wire out; this was the maximum of wire used in the flight.

At the beginning of the flight the weather was partly cloudy, but cleared during the afternoon.

The flight was made in the southeast quadrant of a low central over Lake Huron and northwest of a minor low central over North Carolina.

July 23, 1907.—The flight was made with three kites having a total lifting surface of 210 square feet (19.4 square meters).

The maximum amount of wire out was 28,000 feet (8,534 meters); wire out at maximum altitude was 22,000 feet (6,706 meters).

The weather during the flight was generally clear. Light haze observed during the day.

At the time of the flight the station was in the southwest quadrant of an area of low pressure central over Boston, Mass. An extensive high occupied the whole Mississippi Valley from the Gulf of Mexico to the Great Lakes.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 24, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:25 a. m...	70.8	21.3	78	wnw.	11	4.9	1,725	526	70.8	21.8	78	wnw.	11	4.9
7:42 a. m...	70.6	21.5	79	wnw.	10	4.5	2,508	763	68.7	20.4	78	wnw.	......	......
8:01 a. m...	72.0	22.2	78	wnw.	10	4.5	3,791	1,155	63.9	17.7	74	wnw.	......	......
8:38 a. m...	71.0	21.7	79	wnw.	12	5.4	4,720	1,439	59.2	15.1	78	wnw.	......	......
10:11 a. m...	74.0	23.3	70	wnw.	12	5.4	5,336	1,626	59.0	15.0	80	nw.	......	......
11:15 a. m...	76.7	24.8	67	wnw.	13	5.8	8,067	2,459	51.7	10.9	45	nw.	......	......
12:15 p. m...	78:5	25.8	52	wnw.	18	5.8	8,105	2,470	50.2	10.1	46	nw.	......	......
12:51 p. m...	79.5	26.4	53	wnw.	10	4.5	7,942	2,421	52.8	11.6	46	nw.	......	......
1:23 p. m...	79.7	26.5	50	w.	8	3.6	1,725	526	79.7	26.5	50	w.	8	3.6
July 25, 1907.														
7:29 a. m...	71.8	22.1	80	nw.	18	8.0	1,725	526	71.8	22.1	80	nw.	18	8.0
7:37 a. m...	71.8	22.1	80	nw.	18	8.0	4,180	1,274	64.8	17.9	.....	nw.	......	......
7:50 a. m...	71.3	21.8	82	nw.	19	8.5	5,372	1,637	66.1	18.9	.....	nw.	......	......
8:20 a. m...	72.5	22.5	80	nw.	21	9.4	7,975	2,431	57.6	14.2	.....	nw.	......	......
9:26 a. m...	74.0	25.3	78	nw.	19	8.5	7,568	2,307	60.2	15.7	.....	nw.	......	......
10:30 a. m...	76.7	24.8	76	nw.	18	8.0	8,265	2,519	53.9	12.2	.....	nw.	......	......
11:22 a. m...	78.0	25.6	69	nw.	15	6.7	4,644	1,416	65.8	18.5	.....	nw.	......	......
11:32 a. m...	78.5	25.8	71	nw.	13	5.8	1,725	526	78.5	25.8	71	nw.	13	5.8
2d flight.														
11:53 a. m...	78.6	25.9	70	nw.	13	5.8	1,725	526	78.6	25.9	70	nw.	13	5.8
12:15 p. m...	79.5	26.4	66	nw.	13	5.8	4,120	1,256	67.8	19.9	.....	wnw	......	......
1:09 p. m...	81.0	27.2	61	nw.	12	5.4	6,668	2,032	59.5	15.3	.....	wnw	......	......
2:02 p. m...	80.3	26.8	67	nw.	6	2.7	6,194	1,888	61.0	16.1	.....	wsw	......	......
2:40 p. m...	83.5	28.6	63	sw.	4	1.8	1,725	526	83.5	28.6	63	sw.	4	1.8

July 24, 1907.—The flight was made with three kites having a total lifting surface of 257 square feet (23.8 square meters).

The maximum altitude was reached when the greatest amount of wire was out, the amount being 12,000 feet (3,658 meters).

At the beginning of the flight about 2/10 strato-cumulus clouds from west-northwest were observed, slowly diminishing. At an altitude of 5,468 feet (1,667 meters) the uppermost kite was in the base of cumulus clouds, about 2/10 being observed.

At the time of the flight the station was midway between an area of low pressure central over eastern Massachusetts and a high central over northern Alabama. A second low was central over northern Michigan and approaching, with numerous thunderstorms in its southern and western portions.

July 25, 1907.—The first flight was made with four kites having a total lifting surface of 278 square feet (25.7 square meters).

The maximum amount of wire out was 20,000 feet (6,096 meters); wire out at maximum altitude was 19,000 feet (5,791 meters).

The second flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum amount of wire out was 8,000 feet (2,438 meters); wire out at maximum altitude was 7,000 feet (2,134 meters).

The weather was clear during both flights.

At the time of the flights the station was to the southwest of a low central over the lower St. Lawrence Valley, and near the center of a high reaching from the upper Great Lakes to Florida. A thunderstorm occurred at the station between 3:30 and 4:30 p. m.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 26, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:12 a. m....	70.3	21.3	80	nw.	25	11.2	1,725	526	70.3	21.3	80	nw.	25	11.2
7:18 a. m....	70.3	21.3	80	nw.	24	10.7	3,799	1,158	68.4	20.2	.....	nw.	.....	.....
7:26 a. m....	71.0	21.7	77	nw.	23	10.3	3,981	1,213	70.0	21.1	.....	wnw	.....	.....
7:41 a. m....	70.3	21.3	80	nw.	22	9.8	5,866	1,788	65.1	18.4	.....	w.	.....	.....
7:53 a. m....	70.3	21.3	80	nw.	20	8.9	6,025	1,836	64.2	17.9	.....	w.	.....	.....
8:14 a. m....	70.4	21.3	79	nw.	22	9.8	8,008	2,441	58.0	14.4	.....	w.	.....	.....
8:39 a. m....	69.5	20.8	88	nw.	18	8.0	11,334	3,455	44.8	7.1	.....	w.	.....	.....
8:51 a. m....	70.0	21.1	83	nw.	20	8.9	12,405	3,781	40.2	4.5	.....	w.	.....	.....
9:07 a. m....	70.0	21.1	90	nw.	23	10.3	13,544	4,128	36.7	2.7	.....	w.	.....	.....
9:11 a. m....	69.0	20.6	90	nw.	23	10.3	14,141	4,310	34.4	1.4	.....	w.	.....	.....
2d flight.														
5:46 p. m....	74.1	23.4	74	nw.	21	9.4	1,725	526	74.1	23.4	74	nw.	21	9.4
6:00 p. m....	74.5	23.6	74	nw.	21	9.4	4,885	1,489	60.3	15.7	85	nw.	.....	.....
6:17 p. m....	73.6	23.1	70	nw.	30	13.4	6,481	1,975	56.5	13.6	70	nw.	.....	.....
6:39 p. m....	72.5	22.5	75	nw.	27	12.1	4,212	1,284	63.5	17.5	84	nw.	.....	.....
7:09 p. m....	71.2	21.8	77	nw.	29	13.0	1,725	526	71.2	21.8	77	nw.	29	13.0
July 27, 1907.														
7:23 a. m...	55.7	13.2	71	nw.	22	9.8	1,725	562	55.7	13.2	71	nw.	22	9.8
7:29 a. m...	56.2	13.4	72	nw.	21	9.4	4,080	1,244	52.4	11.3	.....	nnw	.....	.....
7:45 a. m...	56.7	13.7	72	nw.	22	9.8	5,970	1,820	56.9	13.8	.....	nnw	.....	.....
7:54 a. m...	57.0	13.9	72	nw.	22	9.8	6,320	1,926	56.0	13.3	.....	nnw	.....	.....
7:59 a. m...	57.7	14.3	68	nw.	23	10.3	6,525	1,989	56.0	13.3	.....	nw.	.....	.....
8:05 a. m...	58.0	14.4	68	nw.	22	9.8	6,638	2,023	56.0	13.3	.....	nw.	.....	.....
8:18 a. m...	58.3	14.6	67	nw.	21	9.4	8,395	2,559	51.5	10.8	.....	nw.	.....	.....
8:40 a. m...	60.0	15.6	68	nw.	21	9.4	9,237	2,816	49.9	9.9	.....	nw.	.....	.....
8:45 a. m...	59.5	15.3	63	nw.	24	10.7	9,690	2,954	49.9	9.8	.....	wnw	.....	.....
9:47 a. m...	62.4	16.9	56	nw.	17	7.6	12,241	3,731	38.0	3.3	.....	wnw	.....	.....
11:10 a. m...	64.5	18.1	58	nw.	19	8.5	7,070	2,155	54.6	12.6	.....	nnw	.....	.....
11:40 a. m...	65.5	18.6	52	nw.	24	10.7	4,654	1,419	59.8	15.4	.....	nnw	.....	.....
11:50 a. m...	65.9	18.8	51	nw.	24	10.7	4,291	1,308	61.6	16.4	.....	nnw	.....	.....
11:53 a. m...	66.3	19.1	51	nw.	24	10.7	3,768	1,148	57.1	13.9	.....	nnw	.....	.....
12:06 p. m...	66.7	19.3	50	nw.	24	10.7	1,725	526	66.7	19.3	50	nw.	24	10.7

July 26, 1907.—The first flight was made with three kites having a total lifting surface of 204 square feet (18.9 square meters).

The maximum amount of wire out was 22,500 feet (6,850 meters); wire out at maximum altitude was 22,500 feet (6,858 meters).

Cloudy during the flight, with rain before end of flight.

The second flight was made with one kite having a lifting surface of 74 square feet (6.8 square meters).

The maximum altitude was reached when the maximum amount of wire, 7,500 feet (2,286 meters), was out.

Cloudiness prevailed during the flight.

At the time of the flights the station was in the south-southwest portion of a marked low central over Montreal, and embracing the whole northeast quarter of the United States. It was accompanied by a large number of thunderstorms.

July 27, 1907.—The flight was made with two kites having a total lifting surface of 142 square feet (13.1 square meters).

The maximum altitude was reached when the maximum amount of wire, 18,500 feet (5,639 meters), was out.

Clear weather prevailed thruout the flight.

At the time of the flight the station was directly in front of a high central over Illinois and Lake Michigan. A secondary low was central over Cape Hatteras, while a very marked depression was central over the St. Lawrence Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
July 29, 1907.	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*
3:16 p. m...	67.3	19.6	....	nw.	18	5.8	1,725	526	67.8	19.6	.....	nw.	18	5.8
3:31 p. m...	68.0	20.0	....	nw.	11	4.9	3,580	1,091	68.7	17.6	.....	nnw.	......	......
3:48 p. m...	68.7	20.4	....	nw.	18	5.8	5,486	1,672	59.6	15.3	.....	nw.	......	......
4:14 p. m...	68.0	20.0	....	nw.	14	6.3	6,725	2,050	55.3	12.9	.....	nw.	......	......
5:05 p. m...	69.5	20.8	....	nw.	10	4.5	1,725	526	69.5	20.8	.....	nw.	10	4.5
July 30, 1907.														
8:59 a. m...	69.0	20.6	80	nw.	17	7.6	1,725	526	69.0	20.6	.....	nw.	17	7.6
9:23 a. m...	70.0	21.1	81	nw.	17	7.6	4,714	1,437	61.1	16.2	.....	nw.	......	......
9:51 a. m...	71.0	21.7	79	nw.	15	6.7	6,298	1,920	54.4	12.4	.....	wnw	......	......
10:30 a. m...	73.2	22.9	78	nw.	15	6.7	1,725	526	73.2	22.9	.....	nw.	15	6.7
July 31, 1907.														
7:25 a. m...	62.2	16.8	79	nw.	11	4.9	1,725	526	62.2	16.8	79	nw.	11	4.9
7:38 a. m...	63.0	17.2	75	nw.	11	4.9	3,608	1,100	60.2	15.7	.....	nw.	......	......
9:30 a. m...	67.5	19.7	65	nw.	8	3.6	4,981	1,518	54.8	12.7	....	nnw	......	......
9:55 a. m...	69.0	20.6	55	nw.	8	3.6	1,725	526	69.0	20.6	55	nw.	8	3.6

July 29, 1907.—The flight was made with one kite having a lifting surface of 121 square feet (11.2 square meters).

The maximum altitude was reached when the maximum amount of wire, 7,500 feet (2,286 meters), was out.

Dense fog began at 8:50 a. m. and lifted at 3 p. m. Clouds passed under the kite at elevations of 2,500 and 6,000 feet (762 and 1,829 meters).

At the time of the flight the whole country east of the Mississippi River, excepting Florida, was dominated by an extensive area of low pressure, central north of the lower Lake region. This well-defined low was accompanied by two minor centers, one over the station and the other over western Tennessee. Rains were general in the South Atlantic and Gulf States.

July 30, 1907.—The flight was made with one kite having a lifting surface of 121 square feet (11.2 square meters).

The maximum amount of wire out was 7,500 feet (2,286 meters); wire out at maximum altitude was 7,250 feet (2,210 meters).

The sky was very nearly clear at 7:30 a. m. At an altitude of 6,300 feet (1,920 meters) low clouds were observed some distance below the kite. At an altitude of 3,420 feet (1,042 meters) the kite was in thin clouds.

At the time of the flight the station was midway between an extensive area of high pressure, central over eastern Kansas, and an area of low pressure, central over the northern portion of the New England States. Fair weather, with moderate temperature, prevailed at the station.

July 31, 1907.—The flight was made with three kites having a total lifting surface of 210 square feet (19.4 square meters).

The maximum amount of wire out was 8,000 feet (2,438 meters); wire out at maximum altitude was 7,000 feet (2,134 meters).

Clear weather prevailed thruout the flight.

At the time of the flight the entire portion of the United States west of the Mississippi River, except Arizona and southern California, was dominated by an area of high pressure central over Montana and Wyoming. An area of low pressure, accompanied by rain, was moving off to the northeastward over the New England States. Fair weather prevailed over the territory surrounding the station.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Aug. 1, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters	° F.	° C.	%		Miles p. h.	Met's p. s.
9:33 a.m...	69.0	20.6	81	w.	9	4.0	1,725	526	69.0	20.6	81	w.	9	4.0
10:01 a.m...	69.2	20.7	79	nw.	12	5.4	3,360	1,024	64.9	18.3	.....	nw.	......	......
10:42 a.m...	71.5	21.9	79	nw.	6	2.7	1,725	526	71.5	21.9	79	nw.	6	2.7
Aug. 2, 1907.														
7:18 a.m..	67.0	19.4	....	w.	16	7.2	1,725	526	67.0	19.4	.....	w.	16	7.2
7:30 a.m...	68.0	20.0	....	w.	16	7.2	3,629	1,106	64.5	18.0	.....	w.	......	......
7:46 a.m...	69.0	20.6	....	w.	18	8.0	5,035	1,535	61.4	16.3	.....	w.	......	......
8:09 a.m...	70.5	21.4	....	w.	20	8.9	7,072	2,156	53.0	11.6	.....	wsw.	......	......
8:45 a.m...	70.4	21.3	....	nw.	23	10.3	9,157	2,791	45.4	7.4	.....	sw.	......	......
9:58 a.m...	73.7	23.2	....	nw.	19	8.5	12,279	3,742	34.1	1.1	.....	sw.	......	......
10:21 a.m...	75.0	23.9	....	w.	17	7.6	9,965	3,037	41.8	5.4	.....	wsw.	......	......
10:45 a.m...	75.0	23.9	....	w.	13	5.8	7,197	2,194	53.0	11.6	.....	w.	......	......
11:00 a.m...	75.5	24.2	....	w.	12	5.4	5,044	1,537	61.6	16.4	.....	w.	......	......
11:11 a.m...	76.0	24.4	....	w.	12	5.4	1,725	526	76.0	24.4	.....	w.	12	5.4
Aug. 3, 1907.														
10:15 a.m...	66.0	18.9	59	nw.	13	5.8	1,720	526	66.0	18.9	59	nw.	13	5.8
10:32 a.m...	68.0	20.0	59	nw.	14	6.3	3,119	951	63.2	17.3	.....	wnw	......	......
11:30 a.m...	68.0	20.0	55	nw.	11	4.9	5,635	1,718	54.2	21.3	.....	w.	......	......
12:06 p.m...	70.0	21.1	55	nw.	10	4.5	7,735	2,358	48.8	9.3	.....	ssw	......	......
12:40 p.m...	71.0	21.7	54	nw.	7	3.1	1,725	526	71.0	21.7	54	nw.	7	3.1

August 1, 1907.—The flight was made with one kite having a lifting surface of 121 square feet (11.2 square meters).

The maximum amount of wire out was 3,400 feet (1,036 meters); wire out at maximum altitude was 2,500 feet (762 meters).

From 8 to 9/10 alto-cumulus and strato-cumulus clouds, moving from the west, were observed during the flight.

At the time of the flight an area of moderately low pressure was central over the station; a depression of greater intensity prevailed over the upper Great Lakes. Scattered thunderstorms occurred in the regions that were influenced by the depressions. An area of high pressure was central over Canada, just north of Montana.

August 2, 1907.—The flight was made with three kites having a total lifting surface of 210 square feet (19.4 square meters).

The maximum amount of wire out was 18,500 feet (5,639 meters); wire out at maximum altitude was 18,500 feet (5,639 meters).

At the time of the flight the sky was partly covered by strato-cumulus and alto-cumulus clouds; about 5/10 at the beginning and gradually diminishing to about 1/10 at the close of the flight.

An area of low pressure was central north of Lake Ontario on the morning of the flight. This was followed by a high, central over the Rocky Mountain Plateau.

August 3, 1907.—The flight was made with two kites having a total lifting surface of 189 square feet (17.5 square meters).

The maximum amount of wire out was 7,500 feet (2,286 meters); wire out at maximum altitude was 7,500 feet (2,286 meters).

Upper clouds were observed during the entire flight; the average amount being 5/10.

At the time of the flight an area of low pressure was passing up the St. Lawrence Valley, while a secondary low was located just south of the station over eastern Virginia and North Carolina. An area of high pressure prevailed over the middle Mississippi and lower Missouri valleys.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity							Dir.	Velocity.	
Aug. 5, 1907.	° F.	° C.	%		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° F.	° C.	%		*Miles p. h.*	*Met's p. s.*
10:20 a.m...	64.4	18.0	...	se.	16	7.2	1,725	526	64.4	18.0	.....	se.	16	7.2
10:33 a.m...	64.5	18.1	....	se.	11	4.9	3,771	1,149	60.4	15.8	.....	ssw	......	......
10:55 a.m...	65.0	18.3	....	s.	12	5.4	5,469	1,667	53.4	11.9	.....	sw.	......	......
11:05 a.m...	65.1	18.4	....	s.	13	5.8	6,450	1,966	49.4	9.7	.....	sw.	......	......
11:40 a.m...	65.6	18.7	....	sse	15	6.7	2,988	911	63.8	17.7	.....	ssw	......	......
11:58 a.m...	65.7	18.7	....	sse	16	7.2	1,725	526	65.7	18.7	.....	sse	16	7.2
Aug. 6, 1907.														
3:32 p.m...	81.5	27.5	....	nw.	11	4.9	1,725	526	81.5	27.5	.....	nw.	11	4.9
3:42 p.m...	80.0	26.7	....	nw.	12	5.4	3,905	1,190	70.2	21.2	.....	nw.	......	......
4:05 p.m.	80.0	26.7	....	nw.	13	5.8	4,949	1,508	64.8	18.2	.....	nw.	......	......
4:46 p.m...	79.5	26.4	....	nw.	13	5.8	6,685	2,038	56.1	13.4	.....	wnw	......	......
5:18 p.m...	78.8	26.0	....	nw.	13	5.8	1,725	526	78.8	26.0	.....	nw.	13	5.8
Aug. 7, 1907.														
7:30 a.m...	68.7	20.4	....	nw.	11	4.9	1,725	526	68.7	20.4	.....	nw.	11	4.9
7:40 a.m...	69.0	20.6	....	nw.	11	4.9	2,890	881	69.0	20.6	.....	nnw	......	......
7.58 a.m...	70.3	21.3	....	nw.	11	4.9	4,287	1,307	64.0	17.8	....	nnw	......	......
8:48 a.m...	71.3	21.8	....	nw.	11	4.9	4,685	1,428	64.9	18.3	.....	n.	......	......
10:10 a.m...	74.0	23.3	....	nw.	12	5.4	6,726	2,050	58.6	14.8	.....	n.	......	......
10:15 a.m...	74.5	23.6	....	nw.	14	6.3	5,815	1,772	66.4	19.1	.....	n.	......	......
10:40 a.m...	75.0	23.9	....	nw.	14	6.3	1,725	526	75.0	23.9	.....	nw.	14	6.3

August 5, 1907.—The flight was made with two kites having a total lifting surface of 195 square feet (18.0 square meters).

The maximum amount of wire out was 7,500 feet (2,286); wire out at maximum altitude was 7,500 feet (2,286 meters).

The sky was obscured by alto-stratus clouds during the entire flight.

At the time of the flight the station was near the center of an area of high pressure covering the Atlantic coast. A barometric depression of considerable extent was central over the western portion of the upper Lake region.

August 6, 1907.—The flight was made with two kites having a total lifting surface of 189 square feet (17.5 square meters).

The maximum amount of wire out was 7,500 feet (2,286 meters); wire out at maximum altitude was 6,760 feet (2,057 meters).

About 1/10 strato-cumulus clouds from the north-northwest were observed at the beginning of the flight, but they gradually disappeared before the close.

At the time of the flight an area of low pressure, central over Minnesota, covered the upper Mississippi Valley and the upper Lake region. Cloudy weather with occasional showers prevailed over a greater part of the Atlantic coast. A high of moderate intensity was central over the eastern coast of Florida.

August 7, 1907.—The flight was made with three kites having a total lifting surface of 263 square feet (24.3 square meters).

The maximum amount of wire out was 9,000 feet (2,743 meters); wire out at maximum altitude was 6,750 feet (2,057 meters).

The sky was partly covered by alto-stratus clouds, moving from the northwest, and gradually increasing in amount thruout the flight.

At the time of the flight moderately high pressure covered the entire United States, with a maximum over the southeastern part. Heavy rain had occurred during the previous twenty-four hours in the middle Mississippi Valley and along the south Atlantic coast. An area of low pressure was central over Canada, north of Lake Ontario.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	M. p. s.
Aug. 8, 1907.														
7:18 a. m...	68.0	20.0	....	nw.	19	8.5	1,725	526	68.0	20.0	.....	nw.	19	8.5
7:31 a. m...	67.5	19.7	....	nw.	19	8.5	3,357	1,021	67.2	19.6	.....	nnw	......	......
7:42 a. m...	68.0	20.0	....	nw.	20	8.9	3,953	1,205	69.4	20.8	.....	nw.	......	......
9:01 a. m...	71.5	21.9	....	nw.	15	6.7	4,843	1,476	64.7	18.2	.....	nw.	......	......
9:16 a. m...	72.3	22.4	....	nw.	15	6.7	1,725	526	72.3	22.4	.....	nw.	15	6.7
2d flight.														
9:21 a. m...	72.0	22.2	....	nw.	15	6.7	1,725	526	72.0	22.2	.....	nw.	15	6.7
10:16 a. m...	75.0	23.9	....	nw.	14	6.3	2,925	892	75.0	23.9	.....	nnw	......	......
10:24 a. m...	75.0	23.9	...	nw.	13	5.8	1,725	526	75.0	23.9	.....	nw.	13	5.8
Aug. 9, 1907.														
7:29 a. m...	69.2	20.7	....	se.	9	4.0	1,725	526	69.2	20.7	....	se.	9	4.0
7:52 a. m...	69.0	20.6	....	se.	9	4.0	2,980	908	65.0	18.4	.. .	se.	......	......
9:54 a. m...	67.5	19.7	...	se.	9	4.0	3,771	1,149	62.5	17.0	.....	se.	......	......
10:41 a. m...	66.0	18.9	....	se.	13	5.8	6,784	2,068	51.6	10.9	.....	ssw	......	......
10:53 a. m...	66.0	18.9	....	se.	12	5.4	7,598	2,316	51.3	10.7	.....	s.	......	......
11:30 a. m...	66.4	19.1	....	e.	12	5.4	4,208	1,283	72.1	22.3	.....	sse	......	......
11:34 a. m...	66.4	19.1	....	se.	12	5.4	3,011	918	66.4	19.1	.....	se.	......	......
11:43 a. m...	66.4	19.1	....	e.	17	7.6	1,725	526	66.4	19.1	.....	e.	17	7.6

August 8, 1907.—The first flight was made with four kites having a total lifting surface of 278 square feet (25.7 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 5,000 feet (1,524 meters).

A few strato-cumulus clouds from the northwest, gradually increasing, were observed during the flight.

The second flight was made with two kites having a total lifting surface of 195 square feet (18.0 square meters).

The maximum amount of wire out was 4,000 feet (1,219 meters); wire out at maximum altitude was 2,500 feet (762 meters).

The strato-cumulus clouds observed at the time of the former flight were still increasing, about 3/10 being visible, moving from the northwest.

At the time of the flights the station was at the southern part of a dividing line between an area of high pressure, central over Lake Michigan, and an area of low pressure, central over southern Maine. Another area of low pressure was central over eastern Nebraska and a moderate high centered over Colorado.

August 9, 1907.—The flight was made with three kites having a total lifting surface of 257 square feet (23.8 square meters).

The maximum amount of wire out was 8,500 feet (2,591 meters); wire out at maximum altitude was 8,500 feet (2,591 meters).

Flight started in light rain, with thunderstorm in valley to the southeast and low fog in valley to the northwest. Rain ended at 8:04 a. m. and the sky was entirely overcast with low clouds, Dense fog with frequent sprinkles of rain prevailed from 9:53 to 11:37 a. m. Fog then became light and continued so until end of flight. Occasional thunder was heard during the entire flight.

At the time of the flight the station was to the north of a center of relatively low pressure over North Carolina, and a moderate high was moving over the New England States. An extensive area of low pressure of considerable intensity was central over the Dakotas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity	
Aug. 10, 1907	° *F.*	° *C.*	*%*		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	*%*		*Miles p. h.*	*Met's p. s.*
8:11 a. m...	64.0	17.8	....	e.	8	3.6	1,725	526	64.0	17.8	.....	e.	8	3.6
8:28 a. m...	64.4	17.8	....	ene	8	3.6	3,844	1,172	56.8	13.8	.....	e.	......	......
8:54 a. m...	63.5	17.5	....	ene	8	3.6	5,361	1,634	52.7	11.5	.....	e.	......	......
9:10 a. m...	64.5	18.1	....	ene.	8	3.6	6,159	1,877	50.9	10.5	.....	e.	......	......
9:47 a. m...	65.5	18.6	....	ne.	8	3.6	7,175	2,187	47.7	8.7	.....	e.	......	......
10:38 a. m...	65.0	18.3	....	ne.	8	3.6	8,460	2,579	48.2	9.0	.....	ene	......	......
11:20 a. m...	64.4	18.0	....	ene	9	4.0	1,725	526	64.4	18.0	.....	ene	9	4.0
Aug. 12, 1907														
2:32 p. m...	79.5	26.4	....	s.	10	4.5	1,725	526	79.5	26.4	.....	s.	10	4.5
3:08 p. m...	79.4	26.3	....	s.	8	3.6	2,700	823	74.1	23.4	.....	s.	......	......
3:58 p. m...	79.6	26.4	....	s.	11	4.9	3,657	1,115	68.2	20.1	.....	sw.	......	......
4:37 p. m...	79.7	26.5	....	s.	8	3.6	5,684	1,717	64.2	17.9	.....	wsw	......	......
5:14 p. m...	79.0	26.1	....	s.	7	3.1	1,725	526	79.0	26.1	.....	s.	7	3.1

August 10, 1907.—The flight was made with two kites having a total lifting surface of 189 square feet (17.5 square meters).

The maximum amount of wire out was 15,000 feet (4,572 meters); wire out at maximum altitude was 12,500 feet (3,810 meters).

Light fog prevailed during the early part of the flight until 9:00 a. m. The cloudiness which was 1/10 at 9:00 a. m., increased steadily. Light rain occurred toward the end of flight.

At the time of the flight an area of low pressure was central over the Southeastern States, while high pressure prevailed over the Great Lakes.

August 12, 1907.—The flight was made with three kites having a total lifting surface of 293 square feet (27.2 square meters).

The maximum amount of wire out was 8,000 feet (2,438 meters).

The sky was about 1/10 covered with cumulus clouds during the flight.

At the time of the flight the weather over the whole eastern half of the United States was dominated by low pressure, with centers over Arkansas and Ontario. Moderately high pressure prevailed over the west, with centers over Nebraska and Washington.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Aug. 13, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:17 a.m.	72.0	22.2	....	wnw	24	10.7	1,725	526	72.0	22.2	.....	nw.	24	10.7
7:22 a.m.	72.0	22.2	....	nw.	24	10.7	3,299	1,006	70.2	21.2	.....	nw.	......	......
7:32 a.m.	72.3	22.4	....	nw.	25	11.2	3,948	1,203	70.9	21.6	.....	nw.	......	......
7:51 a.m.	72.7	22.6	....	nw.	25	11.2	4,609	1,405	70.9	21.6	.....	wnw	......	......
7:53 a.m.	72.7	22.6	....	nw.	25	11.2	4,401	1,341	72.2	22.3	.....	wnw	......	......
8:31 a.m.	72.5	22.5	....	nw.	26	11.6	3,785	1,154	77.4	25.2	.....	wnw	......	......
10:26 a.m.	74.5	23.6	....	nw.	19	8.5	6,698	2,042	58.8	14.9	.....	w.	......	......
10:35 a.m.	73.5	23.1	....	nw.	20	8.9	5,426	1,654	62.8	17.1	.....	w.	......	......
10:53 a.m.	73.0	22.8	...	nw.	21	9.4	4,302	1,311	64.8	18.7	.....	wnw	......	......
11:10 a.m.	72.7	22.6	....	nw.	20	8.9	3,594	1,095	65.1	18.4	.....	nw.	......	......
11:18 a.m.	72.2	22.3	....	nw.	18	8.0	2,832	863	66.6	19.2	.....	nnw	......	......
11:31 a.m.	72.2	22.2	....	nnw	18	8.0	1,725	526	72.0	22.2	.....	nnw	18	8.0
Aug. 14, 1907														
8:10 a.m.	62.3	16.8	....	nw.	14	6.3	1,725	526	62.3	16.8	.....	nw.	14	6.3
8:16 a.m.	63.0	17.2	....	nw.	15	6.7	3,475	1,054	59.0	15.0	.....	nw.	......	......
8:28 a.m.	62.8	17.1	....	nw.	17	7.6	5,118	1,559	55.1	12.8	.....	nw.	......	......
8:40 a.m.	62.8	17.1	....	nw.	18	8.0	5,109	1,558	55.4	13.0	.....	nw.	......	......
8:46 a.m.	62.8	17.1	....	nw.	17	7.6	6,048	1,844	59.2	15.1	.....	nw.	......	......
8:59 a.m.	63.8	17.7	....	nw.	17	7.6	6,526	1,989	56.2	13.4	.....	nw.	......	......
9:28 a.m.	64.0	17.8	....	nw.	16	7.2	3,990	1,216	57.6	14.2	.....	nnw	......	......
9:34 a.m.	63.5	17.5	....	nw.	16	7.2	2,953	899	57.8	14.3	.....	nnw	......	......
9:44 a.m.	63.2	17.3	....	nw.	16	7.2	1,725	526	63.2	17.3	....	nw.	16	7.2

August 13, 1907.—The flight was made with three kites having a total lifting surface of 210 square feet (19.4 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 7,500 feet (2,286 meters).

At the beginning of the flight the sky was clear, but alto-cumulus clouds moving from the northwest soon began to appear and cloudiness rapidly increased, changing to stratus from the northwest and entirely covering the sky at end of flight.

At the time of the flight the station was directly east of an area of high pressure central over Illinois, while a barometric depression of considerable intensity was central over the lower St. Lawrence Valley.

August 14, 1907.—The flight was made with one kite having a lifting surface of 74 square feet (6.8 square meters).

The maximum amount of wire out was 6,500 feet (1,981 meters); wire out at maximum altitude was 6,500 feet (1,981 meters).

During the flight the sky was partly covered by upper clouds, the amount increasing from 2/10 to 5/10.

At the time of the flight an area of low pressure was passing up the St. Lawrence Valley. A high pressure area, central over the upper Lakes, extended over the station.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Aug. 15, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:28 a. m.	61.0	16.1	....	ese.	10	4.5	1,725	526	61.0	16.1	.....	ese.	10	4.5
7:42 a. m.	61.5	16.4	....	ese.	8	3.6	3,134	955	57.6	14.2	.....	ese.	......	......
8:45 a. m.	62.7	17.1	....	se.	8	3.6	3,590	1,094	55.2	12.9	.....	se.	......	......
8:50 a. m.	62.8	17.1	....	se.	8	3.6	3,594	1,096	55.6	13.1	.....	se.	......	......
9:21 a. m.	63.0	17.2	....	se.	12	5.4	3,876	1,181	54.7	12.6	.....	se.	......	......
9:58 a. m.	64.0	17.8	....	se.	14	6.3	3,825	1,166	58.3	14.6	.....	se.	......	......
10:09 a. m.	64.7	18.2	....	se.	14	6.3	1,725	526	64.7	18.2	.....	se.	14	6.3
Aug. 16, 1907														
7:19 a. m.	60.4	15.8	....	sse.	16	7.2	1,725	526	60.4	15.8	.....	sse.	16	7.2
7:20 a. m.	60.4	15.8	....	see.	16	7.2	2,400	730	59.5	15.3	.....	sse.	......	......
7:28 a. m.	60.5	15.8	....	sse.	17	7.6	3,138	956	62.9	17.2	.....	ssw.	......	......
7:30 a. m.	60.5	15.8	....	sse.	17	7.6	3,383	1,031	63.1	17.3	.....	ssw.	......	......
7:35 a. m.	61.0	16.1	....	sse.	18	8.0	3,916	1,194	64.0	17.8	.....	sw.	......	......
7:45 a. m.	61.0	16.1	...	sse.	18	8.0	4,575	1,394	57.5	14.2	.....	sw.	......	......
7:52 a. m.	61.0	16.1	....	sse.	18	8.0	5,137	1,566	60.0	15.6	.....	sw.	......	......
8:00 a. m.	60.6	15.9	...	sse.	20	8.9	5,210	1,588	60.7	16.0	.....	sw.	......	.....
9:08 a. m.	63.1	17.3	....	sse.	20	8.9	6,276	1,913	57.8	14.4	.....	wsw.	......	......
10:04 a. m.	65.7	18.7	...	sse.	24	10.7	1,725	526	65.7	18.7	.....	sse.	24	10.7

August 15, 1907.—The flight was made with three kites having a total lifting surface of 257 square feet (23.8 square meters).

The maximum amount of wire out was 6,000 feet (1,829 meters); wire out at maximum altitude was 5,000 feet (1,524 meters).

The sky was clear during the entire flight.

During the flight the weather at the station was dominated by an area of high pressure central over the Middle Atlantic States and the St. Lawrence Valley. An area of low pressure was central over North Dakota.

August 16, 1907.—The flight was made with two kites having a total lifting surface of 142 square feet (13.1 square meters).

The maximum amount of wire out was 10,500 feet (3,200 meters); wire out at maximum altitude was 8,000 feet (2,438 meters).

At the beginning of the flight 3/10 alto-cumulus and 2/10 alto-stratus clouds were observed, moving from the west-northwest; these slowly diminished to 1/10 alto-cumulus from the west-northwest, and 2/10 stratus from the south-southwest at end of flight.

At the time of the flight an area of low pressure, central over Lake Superior, influenced the weather over the entire Lake region and upper Mississippi Valley. The station was in the southwestern part of an area of high pressure that was passing off to sea over the New England and Middle Atlantic States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Aug. 17, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:22 a. m....	69.0	20.6	....	wnw	12	5.4	1,725	526	69.0	20.6	.....	wnw	12	5.4
7:29 a. m....	69.0	20.6	....	wnw	12	5.4	2,983	909	67.4	19.7	.....	nw.	......	......
7:48 a. m....	70.0	21.1	....	w.	10	4.5	4,121	1,256	63.6	17.6	.....	nnw	......	......
8:02 a. m....	70.6	21.4	....	w.	10	4.5	5,497	1,676	60.0	15.6	.....	nnw	......	......
8:18 a. m....	71.5	21.9	....	w.	11	4.9	5,862	1,787	60.6	15.9	.....	nnw	......	......
8:31 a. m....	71.8	22.1	....	w.	12	5.4	5,874	1,790	59.6	15.3	.....	nnw	......	......
9:12 a. m....	73.0	22.8	....	nw.	12	5.4	1,725	526	73.0	22.8	.....	nw.	12	5.4
Aug. 19, 1907														
4:44 p. m....	74.2	23.4	....	se.	7	3.1	1,725	526	74.2	23.4	.....	se.	7	3.1
6:21 p. m....	71.0	21.7	....	se.	11	4.9	3,500	1,068	65.3	18.5	.....	ese.	......	......
6:45 p. m....	70.0	21.1	....	se.	12	5.4	4,856	1,828	63.7	17.6	.....	sse.	......	......
6:55 p. m....	69.3	20.7	....	se.	14	6.3	4,349	1,826	64.0	17.8	.....	sse.	......	......
7:03 p. m....	69.0	20.6	....	se.	15	6.7	3,736	1,149	68.4	20.2	.....	ese.	......	......
7:05 p. m....	69.0	20.6	....	se.	15	6.7	3,208	976	64.8	18.2	.....	ese.	......	......
7:13 p. m....	68.9	20.5	....	se.	13	5.8	1,725	526	68.9	20.5	.....	se.	13	5.8
Aug. 20, 1907														
6:00 p. m....	74.7	23.7	....	s.	7	3.1	1,725	526	74.7	23.7	.....	s.	7	3.1
6:50 p. m....	73.6	23.1	....	s.	9	4.0	3,215	980	69.8	21.0	.....	sw.	......	......
7:20 p. m....	73.0	22.8	....	s.	10	4.5	1,725	526	73.0	22.8	.....	s.	10	4.5

August 17, 1907.—The flight was made with one kite having a lifting surface of 121 square feet (11.2 square meters).

The maximum amount of wire out was 7,750 feet (2,362 meters); wire out at maximum altitude was 7,750 feet (2,362 meters).

During the early part of the flight about 4/10 stratus clouds were observed. These gradually disappeared and upper clouds were observed, about 2/10 of the sky being covered at the close of the flight.

At the time of the flight the station was in the northern part of an area of high pressure, central over Georgia, while an area of low pressure was central over Canada, just north of the Great Lakes. Light rains had fallen in New England, the Middle Atlantic States, and the Ohio Valley during the previous twenty-four hours.

August 19, 1907.—The flight was made with three kites having a total lifting surface of 263 square feet (24.3 square meters).

The maximum amount of wire out was 7,000 feet (2,134 meters); wire out at maximum altitude was 7,000 feet (2,134 meters).

About 4/10 cirro-stratus clouds, with a tendency toward clearing, prevailed during the flight.

At the time of the flight the station was in the southern part of an area of high pressure, central over New England, while a second high was moving eastward over Montana. An area of low pressure, accompanied by thunderstorms, overlaid the upper Mississippi Valley, being central over Lake Superior. Excessive precipitation occurred in the Carolinas. Light frost occurred in northern Vermont and heavy frost in Montana.

August 20, 1907.—The flight was made with two kites having a total lifting surface of 195 square feet (18.0 square meters).

The maximum amount of wire out was 3,400 feet (1,036 meters); wire out at maximum altitude was 2,000 feet (610 meters).

About 5/10 strato-cumulus clouds from the west, gradually diminishing, were observed during the flight.

At the time of the flight the station was near the center of an area of high pressure that was passing off to sea over the Middle Atlantic States, while another high was central over South Dakota, with relatively low pressure between the two.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Aug. 21, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:10 a. m...	70.0	21.1	....	nw.	15	6.7	1,725	526	70.0	21.1	.....	nw.	15	6.7
7:27 a. m...	70.7	21.5	....	nw.	16	7.2	2,873	876	70.5	21.4	.....	wnw	......	......
9:32 a. m...	73.9	23.3	....	w.	13	5.8	3,376	1,029	73.1	22.8	.....	wnw	......	......
9:52 a. m...	75.7	24.3	....	w.	12	5.4	4,386	1,339	67.1	19.5	.....	nw.	......	......
10:10 a. m...	76.3	24.6	....	nw.	12	5.4	1,725	526	76.3	24.6	.....	nw.	12	5.4
Aug. 22, 1907														
7:35 a. m...	59.0	15.0	....	n.	8	3.6	1,725	526	59.0	15.0	.....	n.	8	3.6
7:50 a. m...	59.0	15.0	....	n.	8	3.6	2,906	886	56.7	13.7	.....	nne.	......	......
8:10 a. m...	59.6	15.3	....	n.	8	3.6	3,561	1,086	56.3	13.5	.....	nne.	......	......
11:16 a. m...	63.2	17.3	....	n.	6	2.7	4,790	1,460	57.9	14.4	.....	nne.	......	......
11:42 a. m...	64.0	17.8	....	n.	6	2.7	1,725	526	64.0	17.8	.....	n.	6	2.7
Aug. 23, 1907														
8:18 a. m...	54.8	12.7	....	se.	18	8.0	1,725	526	54.8	12.7	.....	se.	18	8.0
8:54 a. m...	57.1	13.9	....	se.	18	8.0	4,007	1,221	61.8	16.6	.....	sse.	......	......
9:30 a. m...	57.0	13.9	....	se.	20	8.9	4,857	1,480	59.6	15.4	.....	s.	......	......
9:46 a. m...	57.7	14.3	....	se.	21	9.4	6,785	2,068	51.5	10.9	.....	s.	......	......
10:26 a. m...	58.2	14.6	....	se.	22	9.8	4,397	1,340	61.8	16.6	.....	sse.	......	......
10:42 a. m...	58.0	14.4	....	se.	22	9.8	3,769	1,149	56.8	13.8	.....	sse.	......	......
10:59 a. m...	58.0	14.4	....	se.	21	9.4	2,922	891	57.2	14.0	.....	sse.	......	......
11:12 a. m...	58.4	14.7	....	se.	21	9.4	1,725	526	58.4	14.7	.....	se.	21	9.4

August 21, 1907.—The flight was made with four kites having a total lifting surface of 278 square feet (25.7 square meters).

The maximum amount of wire out was 9,400 feet (2,865 meters); wire out at maximum altitude was 5,000 feet (1,524 meters).

A clear sky prevailed thruout the flight.

At the time of the flight an area of high pressure was central over southern Wisconsin, while the New England and Middle Atlantic States were covered by relatively low pressure.

August 22, 1907.—The flight was made with two kites having a total lifting surface of 189 square feet (17.5 square meters).

The maximum amount of wire out was 6,000 feet (1,829 meters); wire out at maximum altitude was 5,000 feet (1,524 meters).

The sky was totally obscured by stratus, alto-stratus, and strato-cumulus clouds during the flight.

At the time of the flight an extensive area of high pressure was centered over the lower Lake region; to the southeast of this center and in the vicinity of the station cloudy, showery weather prevailed, with lower temperatures. A barometric depression of considerable intensity was central northwest of the Dakotas.

August 23, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 8,000 feet (2,438 meters).

Rain began before the flight was started and ended at 9:42 a. m. The weather was foggy during the remainder of the flight.

At the time of the flight the pressure was high over the New England and Middle Atlantic States, accompanied by generally cloudy weather. An extensive area of low pressure was central over Minnesota. Excessive precipitation occurred in North Carolina during the previous twenty-four hours.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Aug. 24, 1907	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*
7:24 a. m...	65.0	18.3	....	nw.	16	7.2	1,725	526	65.0	18.3	.....	nw.	16	7.2
7:35 a. m...	65.8	18.5	....	nw.	16	7.2	3,024	922	61.6	16.4	.....	nw.	......	......
7:47 a. m...	65.6	18.7	....	nw.	16	7.2	4,498	1,371	57.6	14.2	.....	nw.	......	......
8:03 a. m...	66.5	19.2	....	nw.	14	6.3	6,030	1,838	57.8	14.3	....	nw.	.....	.....
8:44 a. m...	68.7	20.4	....	nw.	14	6.3	6,737	2,053	54.9	12.7	.....	nw.	......	......
9:17 a. m...	70.7	21.5	....	nw.	15	6.7	6,919	2,109	55.0	12.8	.....	nw.	......	......
9:27 a. m...	70.6	21.4	....	nw.	15	6.7	5,492	1,674	59.2	15.1	.....	nw.	......	......
9:41 a. m...	70.9	21.6	....	nw.	15	6.7	5,002	1,525	56.5	13.6	.....	nw.	......	......
9:55 a. m...	71.1	21.7	....	nw.	15	6.7	4,183	1,275	60.8	16.0	.....	nw.	......	......
10:10 a. m...	72.2	22.8	....	nw.	14	6.3	1,725	526	72.2	22.8	.....	nw.	14	6.3
Aug. 26, 1907														
7:41 a. m...	60.3	15.7	....	w	16	7.2	1,725	526	60.3	15.7	.....	w.	16	7.2
7:47 a. m...	60.3	15.7	....	w.	16	7.2	2,983	909	60.8	16.0	.....	wnw	......	......
8:03 a. m...	60.8	16.0	....	w.	16	7.2	3,559	1,085	59.5	15.3	.....	nw.	......	......
8:24 a. m...	62.0	16.7	....	w.	15	6.7	5,757	1,755	50.0	10.0	.....	nw.	......	......
8:36 a. m...	63.5	17.5	....	w.	14	6.3	7,006	2,135	46.8	8.2	.....	nw.	......	......
8:47 a. m...	64.0	17.8	....	w.	14	6.3	7,101	2,164	48.0	8.9	.....	nw.	......	......
9:13 a. m...	64.2	17.9	....	w.	13	5.8	7,379	2,249	51.4	10.8	.....	nw.	......	......
9:16 a. m...	64.2	17.9	....	w.	13	5.8	7,810	2,380	50.0	10.0	.....	nw.	......	......
9:28 a. m...	64.8	18.2	....	w.	13	5.8	8,163	2,488	48.7	9.3	.....	nw.	......	......
9:40 a. m...	66.0	18.9	....	w.	12	5.4	5,686	1,733	48.7	9.3	.....	nw.	......	......
9:58 a. m...	66.8	19.3	....	w.	11	4.9	1,725	526	66.8	19.3	.....	w.	11	4.9

August 24, 1907.—The flight was made with one kite having a lifting surface of 74 square feet (6.8 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 7,000 feet (2,134 meters).

When the flight was started strato-cumulus clouds covered the sky, but were rapidly diminishing toward the close. At an altitude of 5,194 feet (1,583 meters) strato-cumulus clouds were passing under the kite, and at an altitude of 4,183 feet (1,275 meters) the kite was close to the base of the lower clouds.

At the time of the flight the station was in the southeastern quadrant of an area of low pressure, accompanied by rain, central over Lake Superior. An area of high pressure was central over South Dakota and Nebraska, and another over the southern portion of the Gulf States. Heavy rain fell in the vicinity of the station during the previous twenty-four hours.

August 26, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 8,500 feet (2,591 meters).

A clear sky prevailed thruout the flight.

At the time of the flight an extensive area of high pressure covered the greater part of the United States east of the Mississippi River. An area of low pressure central over the lower St. Lawrence Valley was moving off toward the northeast, while another depression of considerable extent was central over the Dakotas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
	° F.	*° C.*	*%*		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	*° F.*	*° C.*	*%*		*Miles p. h.*	*Met's p. s.*
Aug. 27, 1907														
1:10 p.m...	67.5	19.7	69	s.	8	3.6	1,725	526	67.5	19.7	69	s.	8	3.6
3:58 p.m...	68.8	20.2	67	s.	9	4.0	10,509	3,203	39.6	4.2	.....	wnw	......	......
4:26 p.m...	68.0	20.0	66	s.	10	4.5	8,835	2,693	43.2	6.2	.....	wnw	......	......
4:46 p.m...	68.0	20.0	67	s.	8	3.6	6,555	1,998	53.1	11.7	.....	w.	......	......
5:06 p.m...	67.8	19.9	66	s.	8	3.6	5,728	1,746	56.3	13.5	.....	w.	......	......
5:22 p.m...	69.0	20.6	65	s.	9	4.0	4,156	1,267	59.8	15.4	.....	wsw.	......	......
5:47 p.m...	68.6	20.3	66	s.	6	2.7	1,725	526	68.6	20.3	66	s.	6	2.7
Aug. 28, 1907														
6:51 a.m...	61.9	16.6	97	nw.	15	6.7	1,725	526	61.9	16.6	97	nw.	15	6.7
7:08 a.m...	62.0	16.7	100	nw.	13	5.8	2,945	898	64.4	18.0	.....	wnw.	......	......
7:20 a.m...	62.3	16.8	99	nw.	12	5.4	3,983	1,214	61.0	16.1	.....	wnw.	......	......
7:43 a.m...	62.7	17.1	98	nw.	10	4.5	4,987	1,520	59.4	15.2	.....	wnw.	......	......
7:58 a.m...	63.5	17.5	97	nw.	9	4.0	6,132	1,869	57.6	14.2	.....	wnw.	......	......
9:14 a.m...	65.5	18.6	87	n.	13	5.8	1,725	526	65.5	18.6	87	n.	13	5.8

August 27, 1907.—The flight was made with three kites having a total lifting surface of 210 square feet (19.4 square meters).

The maximum amount of wire out was 12,000 feet (3,658 meters); wire out at maximum altitude was 11,750 feet (3,581 meters).

Cloudy weather with occasional sprinkles prevailed during the flight. At an altitude of 10,500 feet (3,200 meters) above sea level the uppermost kite was in the base of strato-cumulus clouds.

At the time of the flight the station was in the northeastern part of a long ridge of high pressure covering the Gulf and Middle Atlantic States. A barometric depression of considerable extent was central over northern Illinois and was accompanied by heavy precipitation.

August 28, 1907.—The flight was made with two kites having a total lifting surface of 136 square feet (12.6 square meters).

The maximum amount of wire out was 7,500 feet (2,286 meters); wire out at maximum altitude was 7,500 feet (2,286 meters).

During the flight fog was in the valleys on each side of the mountain and light fog was blowing over the station from the northwest. From 2/10 to 5/10 strato-cumulus clouds were observed at intervals. At an altitude of 6,132 feet (1,869 meters) the uppermost kite was above strato-cumulus clouds.

At the time of the flight the whole eastern part of the country was dominated by relatively high pressure, excepting the lower St. Lawrence Valley, where a low-pressure area was moving off to the northeast. Light rains had fallen during the previous twenty-four hours in southern New England and thence westward to the Ohio Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Aug. 29, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
4:26 p.m...	70.0	21.1	60	nw.	8	3.6	1,725	526	70.0	21.1	60	nw.	8	3.6
4:45 p.m...	70.0	21.1	....	nw.	8	3.6	2,383	726	65.4	18.6	.....	nw.	......	......
7:00 p.m...	68.2	20.1	....	n.	4	1.8	1,725	526	68.2	20.1	.....	n.	4	1.8
Aug. 30, 1907														
10:49 a.m...	67.5	19.7	....	w.	12	5.4	1,725	526	67.5	19.7	.....	w.	12	5.4
11:54 a.m...	66.5	19.2	....	nw.	10	4.5	3,729	1,137	61.8	16.8	.....	nw.	......	......
12:23 p.m. .	68.0	20.0	....	nw.	12	5.4	1,725	526	68.0	20.0	.....	nw.	12	5.4
Aug. 31, 1907														
7:31 a.m...	62.8	17.1	....	nw.	15	6.7	1,725	526	62.8	17.1	.....	nw.	15	6.7
7:38 a.m...	64.0	17.8	....	nw.	16	7.2	6,602	2,012	50.4	10.2	.....	nnw.	......	......
8:28 a.m...	64.8	18.2	....	nw.	16	7.2	7,435	2,266	46.0	7.8	.....	nnw.	......	......
9:07 a.m...	67.0	19.4	....	nw.	16	7.1	7,700	2,347	53.1	11.7	.....	nnw.	......	......
9:43 a.m...	68.0	20.0	....	nw.	16	7.2	6,522	1,988	51.1	10.6	.....	nnw.	......	......
9:59 a.m...	68.0	20.0	....	nw.	16	7.2	5,437	1,657	55.6	13.1	.....	nnw.	......	......
10:16 a.m...	68.8	20.4	....	nw.	16	7.2	4,517	1,377	58.1	14.5	.....	n.	......	......
10:32 a.m...	69.5	20.8	....	nw.	16	7.2	3,421	1,043	61.4	16.3	.....	nnw.	......	......
10:47 a.m...	69.5	20.8	....	nw.	16	7.2	2,591	790	64.6	18.1	.....	nnw.	......	......
11:00 a.m...	69.6	20.9	....	nw.	16	7.2	1,725	526	69.6	20.9	.....	nw.	16	7.2

August 29, 1907.—The flight was made with one kite having a lifting surface of 121 square feet (11.2 square meters).

The maximum amount of wire out was 1,500 feet (457 meters); wire out at maximum altitude was 1,500 feet (457 meters).

About 2/10 alto-stratus clouds, moving from the northwest, were observed during the flight.

At the time of the flight the weather in the vicinity of the station was influenced by an area of high pressure central over the lower Lake region. A barometric depression of considerable intensity was central over the lower St. Lawrence Valley, and a greater depression was moving into the United States from the northwest.

August 30, 1907.—The flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum amount of wire out was 4,000 feet (1,372 meters); wire out at maximum altitude was 3,750 feet (1,143 meters).

Cloudy weather, accompanied by light showers, prevailed on the morning the flight was made.

At the time of the flight the station was near the center of an area of high pressure covering the Middle Atlantic States. Relatively low pressure covered the western half of the United States, except the extreme northwest.

August 31, 1907.—The flight was made with one kite having a lifting surface of 74 square feet (6.8 square meters).

The maximum amount of wire out was 12,000 feet (3,658 meters); wire out at maximum altitude was 12,000 feet (3,658 meters).

At the beginning of the flight fog was in the valleys on each side of the mountain and a few cirro-stratus clouds, moving from the northwest, were observed. Shortly after, cumulus clouds began forming, and at 9:30 a. m. 5/10 from the northwest were observed, but they gradually diminished toward end of flight. The kite was above the clouds at an altitude of 4,517 feet (1,377 meters) above sea level.

At the time of the flight the eastern part of the United States was dominated by an area of high pressure central over the upper Great Lakes. An area of low pressure was central north of the Dakotas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 2, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:29 a. m...	65.8	18.8	....	w.	14	6.3	1,725	526	65.8	18.8	.....	w.	14	6.3
8:00 a. m...	66.5	19.2	....	w.	18	8.0	2,953	900	67.2	19.6	.....	w.	......	......
8:15 a. m...	67.0	19.4	....	w.	21	9.4	4,021	1,226	68.1	20.1	.....	nw.	......	......
8:30 a. m. .	66.6	19.2	....	w.	22	9.8	5,164	1,574	65.6	18.7	.....	wnw	......	......
8:55 a. m...	70.5	21.4	....	w.	19	8.5	6,553	1,997	60.7	15.9	.....	wnw	......	......
9:17 a. m...	71.0	21.7	....	w.	18	8.0	6,593	2,010	59.4	15.2	.....	wnw	......	......
9:42 a. m...	69.8	21.0	....	w.	19	8.5	1,725	526	69.8	21.0	.....	w.	19	8.5
Sept. 3, 1907.														
7:22 a. m...	70.4	21.3	....	w.	11	4.9	1,725	526	70.4	21.3	.....	w.	11	4.9
7:34 a. m...	70.5	21.4	....	w.	12	5.4	2,688	819	68.8	20.4	.....	wsw.	......	......
8:00 a. m...	70.0	21.1	....	w.	12	5.4	3,367	1,026	63.9	17.7	.....	wsw.	......	......
8:36 a. m..	69.8	21.0	....	w.	11	4.9	4,541	1,384	61.4	16.3	.....	w.	......	......
9:54 a. m...	71.8	20.1	....	w.	7	3.1	1,725	526	71.8	20.1	.....	w.	7	3.1
Sept. 4, 1907.														
6:30 p. m...	66.0	18.9	....	se.	11	4.9	1,725	526	66.0	18.9	.....	se.	11	4.9
6:13 p. m...	65.3	18.5	....	se.	12	5.4	4,990	1,521	59.4	15.2	.....	ssw.	......	......
7:01 p. m...	64.9	18.3	....	se.	10	4.5	4,618	1,306	64.6	18.1	.....	s.	......	......
7:05 p. m...	64.8	18.2	....	se.	10	4.5	3,846	1,172	63.0	17.2	.....	s.	......	......
7:23 p. m...	65.0	18.3	....	se.	13	5.8	1,725	526	65.0	18.3	.....	se.	13	5.8

September 2, 1907.—The flight was made with one kite having a lifting surface of 74 square feet (6.8 square meters).

The maximum amount of wire out was 7,500 feet (2,286 meters); wire out at maximum altitude was 7,000 feet (2,134 meters).

At the time of the flight about 9/10 clouds, with occasional sprinkles, were observed, but the tendency was toward clearing at the end of the flight.

At the beginning of the flight the station was in the southern part of an area of low pressure, accompanied by showers and thunderstorms, central over Lake Ontario. The pressure was moderately high over the North Carolina coast.

September 3, 1907.—The flight was made with two kites having a total lifting surface of 142 square feet (13.1 square meters).

The maximum amount of wire out was 5,000 feet (1,524 meters); wire out at maximum altitude was 5,000 feet (1,524 meters).

About 2/10 alto-cumulus, 2/10 alto-stratus, and 3/10 strato-cumulus, from the west, were observed during the flight.

At the time of the flight the weather at the station was influenced by an area of low pressure, accompanied by showers, central over Pennsylvania. Heavy precipitation had occurred in New England and Pennsylvania during the previous twenty-four hours. Areas of high pressure were central over North Dakota and the lower St. Lawrence Valley.

September 4, 1907.—The flight was made with one kite having a lifting surface of 121 square feet (11.2 square meters).

The maximum amount of wire out was 5,000 feet (1,524 meters); wire out at maximum altitude was 5,000 feet (1,524 meters).

The sky was covered with low hanging clouds, mostly nimbus in character, during the flight.

During the time of the flight, high pressure continued over the St. Lawrence Valley. The weather at the station was dominated by an area of low pressure over the Middle and South Atlantic states. Several thunderstorms occurred during the day, accompanied by heavy rain.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 5, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
4:50 p. m....	75.2	24.0	....	nw.	9	4.0	1,725	526	75.2	24.0	.....	nw.	9	4.0
5:05 p. m....	74.8	23.5	....	nw.	8	3.6	3,559	1,085	69.9	21.1	.....	wnw	......	......
5:31 p. m....	72.8	22.6	59	nw.	6	2.7	5,859	1,786	55.9	13.3	.....	w.	......	......
6:23 p. m....	70.4	21.8	....	nw.	10	4.5	8,398	2,560	40.7	4.9	.....	w.	......	......
6:44 p. m....	69.8	20.7	59	nw.	11	4.9	9,262	2,823	36.1	2.8	.....	w.	......	......
7:05 p. m....	68.8	20.4	....	nw.	12	5.1	9,775	2,980	32.6	0.4	.....	w.	......	......
7:29 p. m....	68.0	20.0	....	nw.	14	6.3	11,085	3,379	28.7	—1.8	.....	w.	......	......
7:46 p. m....	67.8	19.9	....	nw.	15	6.7	12,015	3,698	28.2	—2.1	.....	w.	......	......
8:00 p. m....	67.5	19.7	....	nw.	16	7.2	10,234	3,119	27.4	—2.5	.....	w.	......	......
8:25 p. m....	67.0	19.4	....	nw.	18	8.0	6,624	2,019	48.1	9.0	.....	w.	......	......
9:10 p. m....	66.6	19.2	....	nw.	20	8.9	1,725	526	66.6	19.2	.....	nw.	20	8.9
Sept. 6, 1907.														
7:30 a. m...	59.5	15.3	70	nw.	26	11.6	1,725	526	59.5	15.3	70	nw.	26	11.6
7:42 a. m...	60.3	15.7	71	nw.	25	11.2	3,967	1,209	53.6	12.0	.....	nw.	......	......
7:54 a. m...	60.5	15.8	71	nw.	24	10.7	5,059	1,542	49.5	9.7	.....	nw.	......	......
8:05 a. m...	60.8	16.0	70	nw.	21	9.4	5,608	1,709	46.9	8.3	.....	nw.	......	......
9:27 a. m...	64.0	17.8	60	nw.	28	12.5	6,939	2,115	51.1	10.6	.....	nw.	......	......
10:00 a. m..	64.5	18.1	58	nw.	31	13.9	8,044	2,452	45.1	7.7	.....	nw.	......	......
10:36 a. m...	66.0	18.9	58	nw.	24	10.7	9,302	2,836	41.9	5.5	.....	wnw	......	......
11:09 a. m...	67.0	19.4	54	nw.	23	10.3	11,059	3,371	34.0	1.1	.....	sw.	......	......
12:12 p. m...	67.6	19.8	54	nw.	18	8.0	12,955	3,949	29.7	—1.8	.....	w.	......	......

September 5, 1907.—The flight was made with five kites having a total lifting surface of 316 square feet (29.2 square meters).

The maximum amount of wire out was 18,000 feet (5,486 meters); wire out at maximum altitude was 17,000 feet (5,182 meters).

About 3/10 alto-cumulus clouds were visible during the flight. A few strato-cumulus clouds were visible during the early part of the flight, but soon disappeared.

During the flight an area of comparatively low pressure was central over the lower Lakes and extended over the station. An area of high pressure was central over western Tennessee, northern Mississippi, and Alabama.

September 6, 1907.—The flight was made with four kites having a total lifting surface of 278 square feet (25.7 square meters).

The maximum amount of wire out was 18,250 feet (5,563 meters); wire out at maximum altitude was 18,200 feet (5,547 meters).

A few lower clouds were observed at the beginning of the flight; these increased to about 2/10.

At the time of the flight an area of low pressure was located over the St. Lawrence Valley; the high pressure of the preceding day had moved northward and was central over the lower Ohio Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 7, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:15 a. m....	56.8	13.5	83	nw.	15	6.7	1,725	526	56.8	13.5	83	nw.	15	6.7
7:45 a. m....	58.0	14.4	81	nw.	14	6.3	2,818	859	57.4	14.1	.....	nw.	......	......
9:09 a. m....	61.4	16.3	....	nw.	12	5.4	3,116	950	60.6	15.9	.....	nw.	......	......
9:44 a. m....	62.0	16.7	75	nw.	10	4.5	1,725	526	62.0	16.7	75	nw.	10	4.5
Sept. 9, 1907.														
9:45 a. m...	66.8	19.3	92	se.	12	5.4	1,725	526	66.8	19.3	92	se.	12	5.4
10:02 a. m...	66.5	19.2	92	se.	12	5.4	2,781	848	65.3	18.5	.....	sse.	......	......
11:52 a. m...	68.2	20.1	88	se.	15	6.7	3,895	1,187	66.6	19.2	.....	ssw.	......	......
1:00 p. m...	68.0	20.0	90	se.	18	8.0	4,437	1,352	63.4	17.4	.....	sw.	......	......
2:30 p. m...	67.3	19.6	91	se.	14	6.3	1,725	526	67.3	19.6	91	se.	14	6.3
Sept. 10, 1907														
7:32 a. m....	66.3	19.1	100	se.	13	5.8	1,725	526	66.3	19.1	100	se.	13	5.8
7:53 a. m....	66.4	19.1	100	se.	14	6.3	2,415	763	64.8	18.2	.....	sse.	......	......
8:40 a. m....	66.3	19.1	100	se.	17	7.6	3,808	1,161	65.7	18.7	.....	sw.	......	......
9:00 a. m....	66.5	19.2	100	se.	17	7.6	5,000	1,524	66.4	19.1	.....	wsw.	......	......
9:27 a. m....	66.4	19.1	100	se.	12	5.4	6,794	2,071	58.6	14.8	.....	wsw.	......	......
9:42 a. m....	66.5	19.2	100	se.	14	6.3	3,605	1,096	71.1	21.7	.....	sw.	......	......
9:51 a. m....	66.6	19.2	100	se.	14	6.3	1,725	526	66.6	19.2	100	se.	14	6.3

September 7, 1907.—The flight was made with two kites having a total lifting surface of 142 square feet (13.1 square meters).

The maximum amount of wire out was 2,000 feet (610 meters); wire out at maximum altitude was 2,000 feet (610 meters).

About 3/10 cirrus and alto-stratus clouds were visible during the flight.

At the time of the flight the station was near the center of an area of high pressure extending over portions of Virginia, West Virginia, and Tennessee. An area of low pressure occupied the middle and upper Mississippi valleys, while another was central over the lower St. Lawrence Valley.

September 9, 1907.—The flight was made with four kites having a total lifting surface of 248 square feet (22.9 square meters).

The maximum amount of wire out was 8,000 feet (2,438 meters); wire out at maximum altitude was 6,000 feet (1,829 meters).

The sky was covered with strato-cumulus clouds during the entire flight.

At the time of the flight the station was surrounded by an area of comparatively low pressure, central over Lake Michigan. An area of high pressure had overspread the upper Missouri Valley and the Dakotas, and another was central over the lower St. Lawrence Valley.

September 10, 1907.—The flight was made with two kites having a total lifting surface of 112 square feet (10.3 square meters).

The maximum amount of wire out was 7,000 feet (2,134 meters); wire out at maximum altitude was 7,000 feet (2,134 meters).

The flight was started in dense fog and occasional misting occurred during the flight. The upper limit of the fog was at an altitude of about 3,600 feet (1,097 meters) above sea level.

At the time of the flight the station was to the east of an area of low pressure central over southern Indiana. Heavy precipitation accompanied this disturbance, and light showers had previously occurred over the Middle Atlantic States. An area of high pressure was central over Maine, while another prevailed over northwestern Texas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 11, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:34 a.m....	66.2	19.0	100	s.	12	5.4	1,725	526	66.2	19.0	100	s.	12	5.4
7:43 a.m....	62.2	19.0	100	s.	13	5.8	2,863	873	64.8	18.2	.....	sw.	......	......
7:56 a.m....	66.2	19.0	....	s.	12	5.4	4,041	1,232	61.2	16.2	.....	sw.	......	......
8:09 a.m....	66.3	19.1	....	s.	12	5.4	5,173	1,577	55.4	13.0	.....	sw.	......	......
8:50 a.m....	67.5	19.7	97	s.	16	7.2	7,068	2,154	54.9	12.7	.....	wsw.	......	......
9:45 a.m....	68.0	20.0	....	se.	11	4.9	1,725	526	68.0	20.0	.....	se.	11	4.9
Sept. 12, 1907														
7:32 a.m....	58.1	14.5	....	w.	24	10.7	1,725	526	58.1	14.5	.....	w.	24	10.7
7:41 a.m....	58.5	14.7	64	w.	21	9.4	4,152	1,266	53.0	11.7	.....	nw.	......	......
7:55 a.m....	59.0	15.0	65	w.	22	9.8	5,425	1,654	53.0	11.7	.....	nw.	......	......
8:55 a.m....	61.8	16.6	62	w.	19	8.5	6,547	1,996	46.3	7.9	.....	nw.	......	......
9:17 a.m....	62.7	17.1	....	w.	15	6.7	3,912	1,192	51.7	10.9	.....	nw.	......	......
9:24 a.m....	63.0	17.2	....	w.	13	5.8	3,024	922	54.8	11.0	.....	wnw	......	......
9:40 a.m....	64.0	17.8	....	w.	17	7.6	1,725	526	64.0	17.8	...	w.	17	7.6

September 11, 1907.—The flight was made with one kite having a lifting surface of 74 square feet (6.8 square meters).

The maximum amount of wire out was 7,500 feet (2,286 meters); wire out at maximum altitude was 7,500 feet (2,286 meters).

The flight was started in a dense fog, gradually becoming light and finally lifting at 8:50 a. m., at which time the sky was totally obscured by clouds. The kite was just above strato-cumulus clouds at an altitude of 7,068 feet (2,154 meters) above sea level. Rain began at 9:25 a. m.

At the time of the flight an extensive area of low pressure was central over the upper Lake region, while the west Gulf States were covered by relatively high pressure. Heavy precipitation had previously occurred in Pennsylvania, the Gulf States, and the upper Lake region.

September 12, 1907.—The flight was made with one kite having a lifting surface of 74 square feet (6.8 square meters).

The maximum amount of wire out was 7,500 feet (2,286 meters); wire out at maximum altitude was 7,500 feet (2,286 meters).

A clear sky prevailed thruout the flight.

At the time of the flight the station was in the northeastern portion of an extensive area of high pressure covering the entire southeastern part of the United States. A barometric depression of considerable intensity was moving off over the lower St. Lawrence Valley. Heavy precipitation occurred along the New England and middle Atlantic coasts.

CAPTIVE BALLOON ASCENSIONS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 13, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
5:20 p. m ...	68.8	20.4	....	e.	6	2.7	1,725	526	68.8	20.4	.....	e.	6	2.7
5:40 p. m....	66.5	19.2	64	e.	7	3.1	5,476	1,669	59.4	15.2	.....	s.	......	.....
5:53 p. m....	66.5	19.2	....	e.	7	3.1	4,248	1,295	61.0	16.1	.....	ssw.	......	......
6:07 p. m....	66.4	19.1	....	e.	8	3.6	3,712	1,132	62.8	17.1	.....	ssw.	......	......
6:24 p. m....	65.5	18.6	66	e.	8	3.6	1,725	526	65.5	18.6	66	e.	8	3.6
Sept. 14, 1907														
9:12 a. m...	69.3	20.7	....	se.	7	3.1	1,725	526	69.3	20.7	.....	se.	7	3.1
9:23 a. m...	69.3	20.7	....	se.	8	3.6	2,616	798	63.6	17.5	.....	wsw.	......	......
10:00 a. m...	69.6	20.9	....	se.	9	4.0	1,725	526	69.6	20.9	.....	se.	9	4.0

RESULTS OF KITE FLIGHT.

Sept. 14, 1907														
12:04 p. m...	71.8	22.1	....	se.	13	5.8	1,725	526	71.8	22.1	.....	se.	13	5.8
12:58 p. m...	72.0	22.2	....	s.	16	7.2	3,505	1,068	62.6	17.0	.....	se.	......	......
1:32 p. m...	72.4	22.4	....	se.	14	6.3	4,979	1,518	56.3	13.5	.....	se.	......	......
1:58 p. m...	72.0	22.2	....	se.	15	6.7	5,336	1,626	60.4	15.1	.....	sse.	......	......
2:08 p. m...	72.0	22.2	....	se.	17	7.6	3,683	1,123	61.9	16.6	.....	sse.	......	......
2:40 p. m...	72.0	22.2	....	se.	14	6.3	1,725	526	72.0	22.2	.....	se.	14	6.3

September 13, 1907.—The flight was made with two captive balloons. Winds were very light, especially for first 2,000 feet (610 meters), the balloons drifting away but slightly.

The maximum amount of wire used was 6,000 feet (1,829 meters).

A clear sky prevailed thruout the flight.

At the time of the flight the station was near the center of an area of high pressure covering the entire eastern part of the United States. A trough of low pressure extended from Minnesota to southern California. Heavy rains had occurred in the Gulf States during the previous twenty-four hours.

September 14, 1907.—The first flight was made with two captive balloons and only 2,000 feet (610 meters) of wire were used.

The second flight was made with three kites having a total lifting surface of 180 square feet (16.6 square meters).

The maximum amount of wire out was 6,600 feet (2,012 meters); wire out at maximum altitude was 6,000 feet (1,829 meters).

A few alto-cumulus clouds, moving from the southeast, were observed during the flight.

At the time of the flights the entire portion of the United States, east of the Mississippi Valley, was covered by high pressure, the maximum being near the station. The high was accompanied by clear, cool weather. Low pressure was moving in over Montana from the northwest.

CAPTIVE BALLOON ASCENSION.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
Sept. 16, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
8:02 p. m...	77.6	25.3	60	s.	7	3.1	1,725	526	77.6	25.3	60	s.	7	3.1
8:15 p. m...	78.8	25.6	59	s.	6	2.7	3,807	1,160	68.7	20.4	....	sw.	......	......
8:38 p. m...	77.7	25.4	58	s.	6	2.7	1,725	526	77.7	25.4	58	s.	6	2.7

RESULTS OF KITE FLIGHTS.

Date and hour.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.
Sept. 17, 1907														
7:21 a. m...	69.2	20.7	77	w.	17	7.6	1,725	526	69.2	20.7	77	w.	17	7.6
7:30 a. m...	69.5	20.8	77	w.	16	7.2	2,938	896	67.3	19.6	.....	nw.	......	......
8:21 a. m...	71.3	21.8	72	w.	25	11.2	3,751	1,143	71.7	21.7	....	wnw	......	......
9:06 a. m...	72.0	22.2	73	w.	22	9.8	4,524	1,379	69.6	20.9	.....	wnw	......	......
10:09 a. m...	73.0	22.8	72	nw.	22	9.8	4,708	1,435	68.7	20.4	.....	wnw	......	......
11:15 a. m...	74.0	23.3	74	nw.	20	8.9	5,529	1,685	63.7	17.6	.....	wnw	......	......
11:22 a. m...	74.0	23.3	75	nw.	20	8.9	4,775	1,455	65.3	18.5	.....	nw.	......	......
11:27 a. m...	74.0	23.3	76	nw.	15	6.7	3,967	1,209	65.5	18.6	.....	nw.	......	......
11:36 a. m...	74.5	23.6	74	nw.	16	7.2	1,725	526	74.5	23.6	74	nw.	16	7.2
Sept. 18, 1907														
4:08 p. m...	71.0	21.7	88	e.	9	4.0	1,725	526	71.0	21.7	88	e.	9	4.0
4:12 p. m...	70.3	21.3	....	e.	10	4.5	2,163	659	68.4	20.2	.....	ese.	......	......
4:32 p. m...	69.0	20.6	....	e.	11	4.9	2,846	868	65.7	18.7	.....	ese.	......	......
5:17 p. m...	67.0	19.4	....	e.	11	4.9	3,476	1,060	63.3	17.4	.....	s.	......	......
5:30 p. m...	67.0	19.4	98	e.	11	4.9	1,725	526	67.0	19.4	98	e.	11	4.9

September 16, 1907.—The flight was made with two captive balloons and at the maximum altitude reached 4,000 feet (1,219 meters) of wire were out.

A few cirro-stratus clouds, moving from the southwest, were observed during the flight.

At the time of the flight the station was near the center of an extensive area of high pressure covering the Atlantic and Gulf coast States. A slight barometric depression, lowest near Lake Superior, prevailed over the middle West. Heavy rain had fallen in the Gulf coast districts.

September 17, 1907.—The flight was made with three kites having a total lifting surface of 180 square feet (16.6 square meters).

The maximum amount of wire out was 8,500 feet (2,591 meters); wire out at maximum altitude was 6,000 feet (1,829 meters).

From 4/10 to 9/10 clouds, from the west and west-northwest, were visible thruout the flight. The clouds were principally strato-cumulus and alto-cumulus.

At the time of the flight the station was near the center of a ridge of high pressure extending from the upper Great Lakes to Florida. An area of low pressure was moving off over Nova Scotia. Light showers had previously occurred in the northern tier of States, the Middle Atlantic States, and Gulf States.

September 18, 1907.—The flight was made with three kites having a total lifting surface of 180 square feet (16.6 square meters).

The maximum amount of wire out was 4,500 feet (1,372 meters); wire out at maximum altitude was 4,000 feet (1,219 meters).

From 7/10 to 10/10 clouds prevailed during the flight. The uppermost kite entered thin clouds at an altitude of 2,163 feet (659 meters) above sea level. Dense fog was forming at close of flight.

At the time of the flight the weather at the station was influenced by an area of high pressure central over the New England States. An area of relatively low pressure was central over South Dakota. Showers and thunderstorms had previously occurred over the Lake region and a greater part of the Middle Atlantic States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 19, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
3:51 p. m....	63.0	17.2	100	ese	11	4.9	1,725	526	63.0	17.2	100	ese	11	4.9
3:57 p. m....	63.0	17.2	100	se.	12	5.4	2,174	663	62.2	16.8	.....	ese	......	......
5:13 p. m....	62.9	17.2	100	se.	11	4.9	2,632	802	68.0	20.0	.....	s.	......	......
5:17 p. m....	62.9	17.2	100	se.	12	5.4	1,724	526	62.9	17.2	100	se.	12	5.4
Sept. 20, 1907														
4:16 p. m....	73.8	23.2	86	sse	13	5.8	1,725	526	73.8	23.2	86	sse	13	5.8
4:28 p. m....	73.6	23.1	....	s.	12	5.4	2,406	733	75.2	24.0	.....	s.	......	......
5:19 p. m....	73.5	23.1	....	s.	11	4.9	4,523	1,379	67.6	19.8	.....	wsw	......	......
5:26 p. m...	73.2	22.9	....	s.	11	4.9	3,954	1,205	69.8	21.0	.....	wsw	......	......
5:36 p. m....	73.0	22.8	....	s.	12	5.4	2,793	851	73.0	22.8	.....	ssw	......	......
6:40 p. m....	73.7	23.2	....	s.	10	4.5	1,725	526	73.7	23.2	.....	s.	10	4.5
Sept. 21, 1907														
7:40 a. m....	71.8	22.1	78	w.	13	5.8	1,725	526	71.8	22.1	78	w.	13	5.8
7:48 a. m...	72.0	22.2	....	w.	13	5.8	2,567	785	72.3	22.4	.....	w.	......	......
7:53 a. m....	72.1	22.3	....	w.	12	5.4	3,698	1,126	68.9	20.5	.....	nw.	......	......
8:02 a. m....	72.5	22.5	....	w.	14	6.3	4,040	1,231	68.5	20.3	.....	nw.	......	......
8:40 a. m....	74.0	23.3	....	w.	16	7.2	4,076	1,242	69.8	21.0	.....	nw.	......	......
9:11 a. m....	75.1	23.9	70	w.	16	7.2	3,647	1,112	71.4	21.9	.....	wnw	......	......
9:40 a. m....	75.7	24.3	69	w.	16	7.2	1,725	526	75.7	24.3	69	w.	16	7.2

September 19, 1907.—The flight was made with three kites having a total lifting surface of 227 square feet (21.0 square meters).

The maximum amount of wire out was 5,000 feet (1,524 meters); wire out at maximum altitude was 1,600 feet (488 meters).

Dense fog prevailed thruout the flight and the upper limit of fog layer was probably about 2,400 feet (732 meters).

At the time of the flight unsettled, showery weather prevailed generally over the entire northern portion of the country from New England and the Middle Atlantic States to the Dakotas. An area of high pressure was central over New England, and an extensive low was centered over Nebraska. Heavy precipitation had previously occurred over the Atlantic coast States.

September 20, 1907.—The flight was made with three kites having a total lifting surface of 180 square feet (16.6 square meters).

The maximum amount of wire out was 5,000 feet (1,524 meters); wire out at maximum altitude was 4,000 feet (1,219 meters).

A clear sky prevailed thruout the flight.

At the time of the flight a storm of considerable intensity was central over Lake Superior. Unsettled weather with showers and thunderstorms was general over the districts influenced by this depression, and heavy precipitation occurred near its center. Moderately high pressure prevailed along the Atlantic coast.

September 21, 1907.—The flight was made with three kites having a total lifting surface of 180 square feet (16.6 square meters).

The maximum amount of wire out was 8,500 feet (2,591 meters); wire out at maximum altitude was 8,500 feet (2,591 meters).

A clear sky prevailed thruout the flight.

At the time of the flight a tropical disturbance was central over the mouth of the Mississippi River, and Lake Superior was the center of another low pressure area, while moderately high pressure prevailed between the two. Warmer weather with occasional showers had occurred in New England and the Middle Atlantic States. The entire northwestern section of the United States was dominated by a high of moderate pressure. A depression of considerable intensity was moving off over the lower St. Lawrence Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m., 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 23, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
5:54 p. m...	63.8	17.7	....	ssw.	8	3.6	1,725	526	63.8	17.7	.....	ssw.	8	3.6
5:57 p. m...	63.6	17.6	....	se.	10	4.5	2,652	808	65.8	18.8	.....	wsw.	.....	.....
6:01 p. m...	63.6	17.6	....	se.	10	4.5	3,061	933	63.5	17.5	.....	w.	.....	.....
6:11 p. m...	63.2	17.3	....	s.	10	4.5	4,212	1,284	59.0	15.0	.....	w.	.....	.....
6:22 p. m...	63.8	17.4	....	s.	10	4.5	5,595	1,705	57.0	13.9	.....	wnw	.....	.....
6:36 p. m...	63.7	17.6	....	s.	11	4.9	6,827	2,081	54.3	12.4	.....	wnw	.....	.....
7:03 p. m...	65.7	18.7	....	sw.	11	4.9	1,725	526	65.7	18.7	.....	sw.	11	4.9
Sept. 24, 1907														
7:28 a. m...	68.0	20.0	56	ssw.	16	7.2	1,725	526	68.0	20.0	56	ssw.	16	7.2
7:32 a. m...	68.2	20.1	57	sw.	16	7.2	3,035	925	65.3	18.5	.....	w.	.....	.....
7:45 a. m...	67.5	19.7	58	sw.	12	5.4	4,209	1,283	59.5	15.3	.....	wnw	.....	.....
7:57 a. m ..	66.8	19.3	61	s.	10	4.5	5,551	1,692	57.6	14.2	.....	wnw	.....	.....
8:33 a. m...	68.0	20.0	61	sw.	12	5.4	6,723	2,049	54.1	12.3	.....	wnw	.....	.....
9:31 a. m...	70.0	21.1	61	sw.	14	6.3	8,040	2,451	52.3	11.3	.....	w.	.....	.....
10:02 a. m...	72.5	22.5	53	sw.	16	7.2	9,539	2,908	48.7	9.3	.....	w.	.....	.....
11:33 a. m...	75.2	24.0	56	sw.	18	5.8	11,800	3,597	34.3	1.3	.....	w.	.....	.....
12:14 p. m...	75.7	24.3	54	sw.	12	5.4	13,541	4,127	25.9	−3.4	.....	w.	.....	.....
12:40 p. m...	76.0	24.4	52	sw.	11	4.9	14,774	4,503	23.5	−4.7	.....	wsw.	.....	.....
2:37 p. m...	79.0	26.1	56	sw.	10	4.5	1,725	526	79.0	26.1	56	sw.	10	4.5

September 23, 1907.—The flight was made with one kite having a lifting surface of 74 square feet (6.8 square meters).

The maximum amount of wire out was 7,000 feet (2,134 meters); wire out at maximum altitude was 7,000 feet (2,134 meters).

About 2/10 cirrus and alto-cumulus clouds were visible during the flight.

At the time of the flight high pressure prevailed over the Canadian Maritime Provinces and over the Northwest. The station was surrounded by an area of low pressure central over Virginia and North Carolina.

September 24, 1907.—The flight was made with four kites having a total lifting surface of 248 square feet (22.9 square meters).

The maximum amount of wire out was 30,000 feet (9,144 meters); wire out at maximum altitude was 30,000 feet (9,144 meters).

At the beginning of the flight a clear sky prevailed, but during the remainder some few alto-cumulus and strato-cumulus clouds were observed.

At the time of the flight an extensive area of low pressure central over Ontario dominated the weather conditions over the eastern half of the country. Showers were general over this section, except in the Ohio Valley, and heavy rain had previously occurred in the Middle Atlantic States and New England. High pressure was moving in from the Northwest, accompanied by much cooler weather, the center being north of the Dakotas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m., 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 25, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:26 p.m...	56.1	13.4	....	nw.	23	10.3	1,725	526	56.1	13.4	.....	nw.	23	10.3
1:31 p.m...	56.0	13.3	....	nw.	24	10.7	2,933	895	48.9	9.4	.....	nw.	......	......
1:44 p.m...	57.2	14.0	....	nw.	24	10.7	4,292	1,308	43.9	6.6	.....	nw.	......	......
1:56 p.m...	57.0	13.9	....	nw.	23	10.3	5,018	1,530	38.8	3.8	.....	nw.	......	......
2:20 p.m...	56.5	13.6	....	nw.	19	8.5	6,805	2,074	30.2	−1.0	.....	nw.	......	......
3:00 p.m...	57.0	13.9	....	nw.	23	10.3	1,725	526	57.0	13.9	.....	nw.	23	10.3
Sept. 26, 1907														
7:30 a.m...	40.5	4.7	75	nw.	11	4.9	1,725	526	40.5	4.7	75	nw.	11	4.9
7:41 a.m...	41.2	5.1	71	nw.	13	5.8	3,131	954	37.8	3.2	.....	nnw.	......	......
7:58 a.m...	41.6	5.3	72	nw.	12	5.4	4,119	1,256	33.6	0.9	.....	nnw.	......	......
8:13 a.m...	43.5	6.4	69	nw.	11	4.9	4,712	1,436	31.5	−0.3	.....	nnw.	......	......
8:26 a.m...	44.6	7.0	....	nw.	12	5.4	4,712	1,436	31.3	−0.4	.....	nnw.	......	......
8:45 a.m...	45.7	7.0	65	nw.	12	5.4	6,698	2,042	39.9	4.4	.....	nw.	......	......
9:18 a.m...	46.5	8.1	66	nw.	12	5.4	8,015	2,443	40.1	4.5	.....	nw.	......	......
9:28 a.m...	48.0	8.9	67	nw.	12	5.4	9,007	2,746	38.1	3.4	.....	wnw	......	......
9:46 a.m...	48.6	9.2	....	nw.	12	5.4	10,051	3,064	39.2	4.0	.....	wnw	......	......
10:33 a.m...	49.6	9.8	55	nw.	12	5.4	11,701	3,566	40.3	4.6	.....	w.	......	......
2:13 p.m...	54.5	12.5	....	w.	13	5.8	5,954	1,815	37.4	3.0	.....	nw.	......	......
2:23 p.m...	64.5	12.5	....	w.	13	5.8	1,725	526	54.5	12.5	.....	w.	13	5.8

September 25, 1907.—The flight was made with one kite having a lifting surface of 68 square feet (6.3 square meters).

The maximum amount of wire out was 8,000 feet (2,438 meters); wire out at maximum altitude was 8,000 feet (2,438 meters).

About 1/10 strato cumulus clouds, moving from the west-northwest, were observed at the beginning of the flight, but the tendency was toward a clear sky thruout the flight.

At the time of the flight a storm was central over the Gulf of St. Lawrence and a strong and cold high pressure area over the interior of the country dominated the weather conditions. Showers had previously occurred in the Lake region, Middle Atlantic States, and New England. Heavy to killing frost had occurred in the region to the southwest of the upper Great Lakes.

September 26, 1907.—The flight was made with four kites having a total lifting surface of 272 square feet (25.2 square meters).

The maximum amount of wire out was 17,000 feet (5,182 meters); wire out at maximum altitude was 17,000 feet (5,182 meters).

From 4/10 to 7/10 cirro-stratus clouds were observed during the flight, but the tendency was toward clearing at the close. A few lower clouds were observed at an altitude of 5,700 feet (1,737 meters) above station. Winds were very changeable in direction and velocity at an altitude of between 3,000 and 4,500 feet (914 and 1,372 meters) above station, calm apparently prevailing most of the time.

At the time of the flight an extensive area of high pressure, central over Ohio, covered the eastern half of the United States. A low-pressure area was moving off over the Gulf of St. Lawrence, and relatively low pressure prevailed over the Southwest.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 27, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:25 a. m...	50.0	10.0	66	s.	13	5.8	1,725	526	50.0	10.0	66	s.	13	5.8
7:33 a. m...	50.3	10.2	....	s.	11	4.9	2,406	733	52.7	11.5	.....	s.	......	......
7:56 a. m...	51.5	10.8	....	s.	13	5.8	2,844	867	53.2	11.8	.....	wsw.	......	......
8:02 a. m...	52.0	11.1	....	s.	15	6.7	3,215	980	51.3	10.7	.....	sw.	......	......
8:24 a. m...	51.0	10.6	68	s.	14	6.3	4,305	1,312	48.7	9.3	.....	sw.	......	......
8:50 a. m...	51.5	10.8	....	s.	8	3.6	5,355	1,632	48.0	8.9	.....	sw.	......	......
9:12 a. m...	52.4	11.3	70	s.	9	4.0	6,104	1,860	46.9	8.3	.....	wsw.	......	......
10:58 a. m...	57.0	13.9	67	s.	20	8.9	8,576	2,614	40.8	4.9	.....	wsw.	......	......
11:36 a. m...	56.3	13.5	....	se.	16	7.2	6,015	1,833	47.3	8.5	.....	sw.	......	......
12:18 p. m...	57.5	14.2	70	se.	16	7.2	1,725	526	57.5	14.2	70	se.	16	7.2
Sept. 28, 1907														
1:27 p. m...	60.7	15.9	86	se.	9	4.0	1,725	526	60.7	15.9	86	se.	9	4.0
1:39 p. m...	61.4	16.3	87	se.	7	3.1	2,874	876	62.1	16.7	.....	s.	......	......
1:47 p. m...	61.6	16.4	58	se.	7	3.1	3,915	1,193	60.8	16.0	.....	s.	......	......
2:08 p. m...	62.0	16.7	87	se.	7	3.1	5,108	1,557	56.8	13.8	.....	s.	......	......
2:47 p. m...	61.0	16.1	89	se.	8	3.6	3,300	1,006	62.2	16.8	.....	se.	......	......
2:59 p. m...	60.4	15.8	92	ese.	9	4.0	1,725	526	60.4	15.8	.....	ese.	9	4.0

September 27, 1907.—The flight was made with three kites having a total lifting surface of 204 square feet (18.9 square meters).

The maximum amount of wire out was 12,500 feet (3,810 meters); wire out at maximum altitude was 12,500 feet (3,810 meters).

From 3/10 to 10/10 alto-cumulus and strato-cumulus clouds, from the west, were observed during the entire flight.

At the time of the flight the station was in the center of a high-pressure area covering the Middle Atlantic States. An extensive area of low pressure, accompanied by showers and thunderstorms, was central over eastern Kansas. Heavy precipitation had occurred in Florida and the southern part of the upper Lake region.

September 28, 1907.—The flight was made with one kite having a lifting surface of 150 square feet (14.1 square meters).

The maximum amount of wire out was 6,000 feet (1,829 meters); wire out at maximum altitude was 6,000 feet (1,829 meters).

The sky was overcast with alto-stratus clouds during the entire flight.

At the time of the flight an extensive area of low pressure, central over the southern part of Lake Michigan, dominated the weather conditions over the Ohio Valley, the Lake region and part of the middle Atlantic coast States. An area of moderately high pressure was central over New England and another over Kansas. Heavy rain had previously fallen in the Lake region, the south Atlantic, and Gulf coast States.

RESULTS OF KITE FLIGHT.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Sept. 30, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:26 a. m.	55.5	13.1	79	nw.	17	7.6	1,725	526	55.5	13.1	79	nw.	17	7.6
7:42 a. m.	57.0	13.9	77	w.	15	6.7	2,899	881	53.8	12.1	.....	wnw	......	......
8:00 a. m.	58.4	14.7	76	w.	15	6.7	3,441	1,049	52.0	11.1	.....	nw.	......	......
8:14 a. m.	59.0	15.0	73	w.	16	7.2	3,986	1,215	49.1	9.5	.....	wnw	......	......
8:40 a. m.	59.7	15.4	73	nw.	19	8.5	4,937	1,505	45.0	7.2	.....	w.	......	......
9:34 a. m.	59.0	15.0	71	nw.	22	9.8	6,539	1,993	50.2	10.1	.....	w.	......	......
9:47 a. m.	59.6	15.3	69	nw.	22	9.8	4,455	1,358	46.8	8.2	.....	wnw	......	......
10:10 a. m.	61.0	16.1	68	nw.	24	10.7	1,725	526	61.0	16.1	68	nw.	24	10.7

September 30, 1907.—The flight was made with three kites having a total lifting surface of 204 square feet (18.9 square meters).

The maximum amount of wire out was 10,000 feet (3,048 meters); wire out at maximum altitude was 6,000 feet (1,829 meters).

From 2/10 to 6/10 strato-cumulus clouds were visible during the flight. At an altitude of 4,937 feet (1,505 meters) above sea level the uppermost kite was in the clouds.

At the time of the flight a ridge of high pressure extended from the Dakotas southeastward to the Middle Atlantic States. The pressure was low in the upper St. Lawrence Valley and over New Mexico. Heavy rain had previously fallen in New England.

THE USE OF UPPER AIR DATA IN WEATHER FORECASTING.

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During the summer of 1907 the writer, as one of the forecasters of the United States Weather Bureau, had the opportunity of comparing upper air conditions, as obtained by kite flights at Mount Weather, Va., with the general meteorological conditions over the eastern part of the United States, as shown by the 8 p. m. daily weather map. In this comparison, brief as it was, some conclusions were reached that it is believed will be useful in the art of weather forecasting. Before reciting these conclusions the reasons for believing that they will serve a useful purpose will be briefly stated.

The problem which confronts the forecaster is essentially one of determining in advance both the path and the rate of movement of areas of high pressure (anticyclones) and areas of low pressure (cyclones). A failure to accurately determine either the path or rate of movement of these great whirling masses of air results disastrously to the forecasts. The surface conditions and their relation to the development and movement of highs and lows afford at best but a suggestion of the action that is probably taking place in the great mass of the atmosphere aloft; hence it was concluded several years ago, that the systematic exploration of the upper air might yield important results, not only to the art of weather forecasting, but also, to the better understanding of the general circulation of the atmosphere.

In the application of the data secured by kite flights to the problem of weather forecasting the first step is naturally an endeavor to correlate the data of the free air with the known facts concerning the development and movement of highs and lows. If thereby a clearer insight into the mechanism of either the high or the low can be gained, by just so much will the art of forecasting be improved. Thus, for example, if the depth or vertical thickness of a low were known one would be able by means of surface observations which now give its horizontal dimensions to exactly delimit its position in the atmosphere. This additional knowledge would greatly add to the ability of the forecaster to correctly outline the future course and intensity of the storm, since it is well known that deep barometric depressions have quite different characteristics from shallow depressions.

Kite observations, when made consecutively, afford the forecaster an opportunity to compare the daily temperature changes aloft with those on the surface. The relation between such changes and their bearing upon the coming weather is an important consideration. Another factor of greater or less significance is the possibility of determining from the temperature and moisture conditions aloft whether clouds will form, what changes existing clouds will undergo, whether they will increase in density and assume the blanket form or break up and disappear. These in general are some of the possibilities of the use of upper air data in weather forecasting.

The material afforded by the kite observations was confined to air pressure, temperature, and wind direction. Considering briefly its application to the problem in hand, it should be remarked that in the beginning it was used largely to check the conclusions which seemed manifest from the surface conditions, to dispel uncertainty when possible; and, in general, to illuminate the situation as it appeared from surface conditions only.

Perhaps the element which was most useful in the beginning was the direction of the wind in the upper layers. The observations on this point disclosed one or two facts of particular interest and importance, viz, the marked tendency of east and south winds to shift to the right with increasing altitude. This fact was brought out in the Blue Hill kite observations and is fully confirmed by those made during the past summer at Mount Weather. The altitude at which the shift occurs varies, but is generally below 3,280 feet (1,000 meters). The deviation in the case of westerly winds, however, is about as apt to be to the left as to the right and this is particularly so in certain types of pressure distribution.

While the direction of the wind is an important consideration to the forecaster the depth of the several layers having different directions is still more so, since, by knowing roughly the latter, he can form an approximation to the height to which the atmosphere is disturbed by the circulation of the high or the low, as the case may be, and consequently the intensity of the storm and the probable extent of territory affected by it. In one case during last summer the early dissolution of a low was foreshadowed by the fact that the wind circulation proper to it extended upward less than 2,500 feet (762 meters) above the station.

The depth of currents which clearly belong to the circulation of highs and lows seems to vary between rather wide limits. In the case of easterly winds, which in most cases are caused by the approach of

a low from the west, the altitudes attained by such currents were found to be generally less than 2,000 feet (610 meters); thus, in twelve cases of east to south winds the average depth of the surface winds was 1,682 feet above the station, the maximum depth was 2,631 feet, the minimum 349 feet. In the case of winds between north and east, the average of six cases was 3,033 feet (924 meters), the maximum was 6,735 feet (1,943 meters), and the minimum was 1,181 feet (360 meters). The maximum depth, 6,735 feet, was caused, however, by an anticyclone whose center was directly north of the station. In a few other cases it was noticed that relatively high easterly winds prevailed when the center of the anticyclone was near to and north by east of the station.

An exceedingly interesting kite flight, which sustains the view that occasionally easterly winds prevail at great altitudes, was made at the Blue Hill Observatory on June 19, 1900 (Annals of the Astronomical Observatory of Harvard College, Vol. XLIII, Part III, page 193). In this flight east-northeast winds prevailed from the earth's surface to an altitude of 13,815 feet (4,211 meters). The wind at that elevation clearly formed a part of the circulation between a strong high that was central in the Lake region and a low off the south Atlantic coast. The preceding examples represent an extreme rather than a mean condition, nevertheless they form an important exception to the general statement that easterly winds are shallow.

The wind at Mount Weather shifts to a westerly quarter on the passage of a low over the station. The altitude of the westerly currents is very much greater than that of the easterly and the velocity is greater. Twelve ascents were made during the summer in which altitudes of 2 miles and over (3 kilometers) were reached. In three of these ascents the wind had a southerly component at the highest elevation reached; in each of the three a marked barometric depression covered the Northeastern States, with lowest pressure over the mouth of the St. Lawrence River. In two other ascents very high altitudes were reached with a different distribution of pressure, viz, a great trough of low barometer in the Mississippi Valley, with strong areas of high pressure on both sides. In both of these cases there was also a southerly component in the wind direction aloft. In the remaining seven cases the winds were west-northwest or west, or in the direction of the prevailing winds in the cirrus cloud level. While it seems probable that the winds up to at least 2 miles above the earth's surface respond to the barometric gradients observed below, it is by no means proved that such is the case. This subject needs further elucidation.

A knowledge of the vertical temperature distribution in highs and

lows, obtained thru kite flights, has afforded valuable information at times. The following general conclusions are drawn from the data thus far collected: (1) The air column in the low is warmer than in the high for such altitudes as were reached by the kites; (2) the region of greatest cold is found in the southeastern quadrant of the high; (3) as the center of the high crosses the meridian of the station and passes to the eastward the temperature conditions aloft become more or less unstable, inversions take place, and the rate of decrease of temperature with increase of altitude diminishes.

Occasionally in the kite flights layers of air are met having temperatures higher than those found in layers of less altitude; in other words the vertical gradient is interrupted and instead of a fall in temperature with increase in altitude a rise is found. Such breaks in the continuity of the vertical temperature gradient are known as inversions.

Temperature inversions may be classed as follows: First, those which occur in the rear of a low or on the immediate eastern front of a high. Inversions in this region are thought to be due to the circumstances that the warm surface layers of the low feel the cooling effect of the high a little sooner than the layers at some distance aloft. This assumption follows the suggestion of Mr. H. Helm Clayton, of the Blue Hill Observatory, viz, that the cold air of the northern portion of the high moves more rapidly east-southeast, than does the high itself, and that, on account of its greater specific weight as compared with that of the air into which it is moving, it sinks toward the earth's surface in an inclined stratum which reaches the ground in the rear of the low. This type of inversion has little or no significance to the forecaster, since, ordinarily, cooling in the rear of the low proceeds until the upper layers, within the limits of observation, at least, acquire a temperature nearly such as is required by the adiabatic rate of cooling for dry air.

A second type of inversion is met when the kites pass from one current of air into another having a different temperature. The existence of a current of warm air flowing along and above a colder one is revealed in this way. Inversions of this nature sometimes afford early indications of the approach of warmer conditions at the surface. The difficulty in properly applying this information at present lies in the fact that the horizontal extension of the warmer current is unknown.

The rate of decrease of temperature with increase of altitude is almost constantly changing, being generally different in the forenoon from what it is in the afternoon.

The sequence of changes in this element in its relation to the drift of highs and lows appears to be about as follows: In the region of cold, dry winds which is found on the eastern front of a high it approaches closely to the adiabatic rate for dry air, viz: 1° F. in 185 feet or 1° C. in 100 meters. From this rate which is the maximum it begins to diminish with the shift of the winds to an easterly quarter and the consequent increase in their moisture content. The rate in rainy weather is rather variable sometimes being almost zero up to a height of nearly a mile and again being much greater.

The rate of decrease most frequently observed was about 3.5° F. per 1,000 feet or 0.6° C. per 100 meters.

The forecasting value of this phenomenon (the vertical temperature gradient) is not yet understood.

The foregoing covers in brief the most important considerations suggested by the summer's experience.

With the addition of the humidity element to the kite observations and the accumulation of data for the cold season it is expected that our present knowledge of the relations which subsist between air conditions aloft and at the surface, respectively, will be greatly increased.

EXPLANATION OF CHARTS IV–VI.

Charts IV, V, and VI have been prepared to show the temperature conditions at the surface of the ground on Mount Weather, Va., and in the air strata above that station at about the time of the morning observation thruout the service, viz, 8 a. m., seventy-fifth meridian time.

The morning hour was chosen because it afforded a better opportunity for a comparison between the conditions aloft and at the surface than any other hour of the day that was available. As the ultimate object of kite flying is to secure data that will be useful in forecasting it is essential that the conditions disclosed by the flights be studied not only in connection with the local surface temperature, wind, etc., but also with the general distribution of temperature, wind, etc., as shown by the daily weather map.

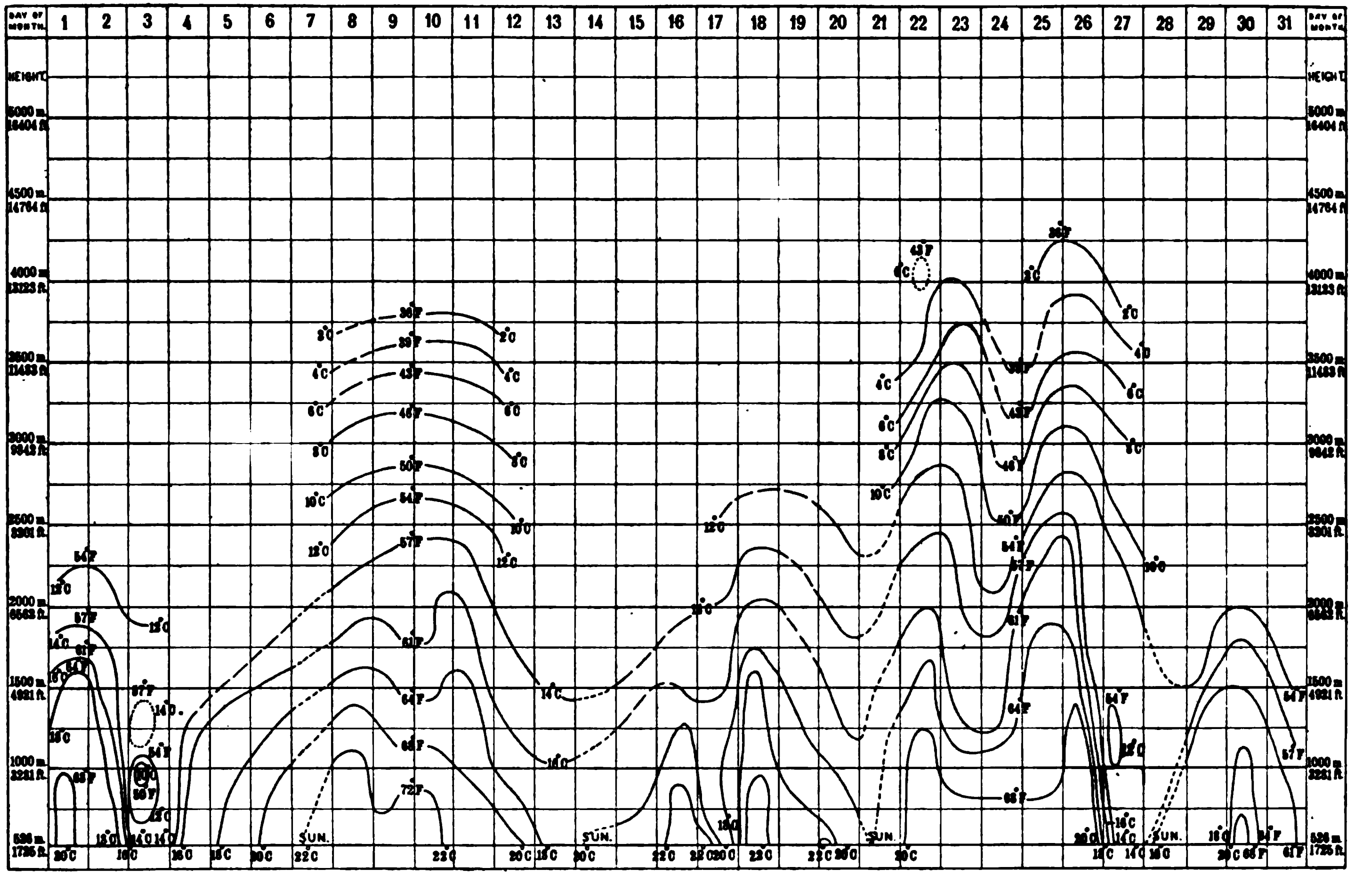
The majority of the flights were made at or near the morning observation hour. The temperatures secured by flights between 7:30 and 8:30 a. m., at altitudes less than 1,500 meters, were used as of the hour 8 a. m. In the region above 1,500 meters it was assumed that the diurnal variation in temperature could be safely neglected.[1] According-

[1] See Annals of the Astronomical Observatory at Harvard College, Vol. LVIII, Part 1. The Diurnal and Annual Periods of Temperature, etc., by H. Helm Clayton.

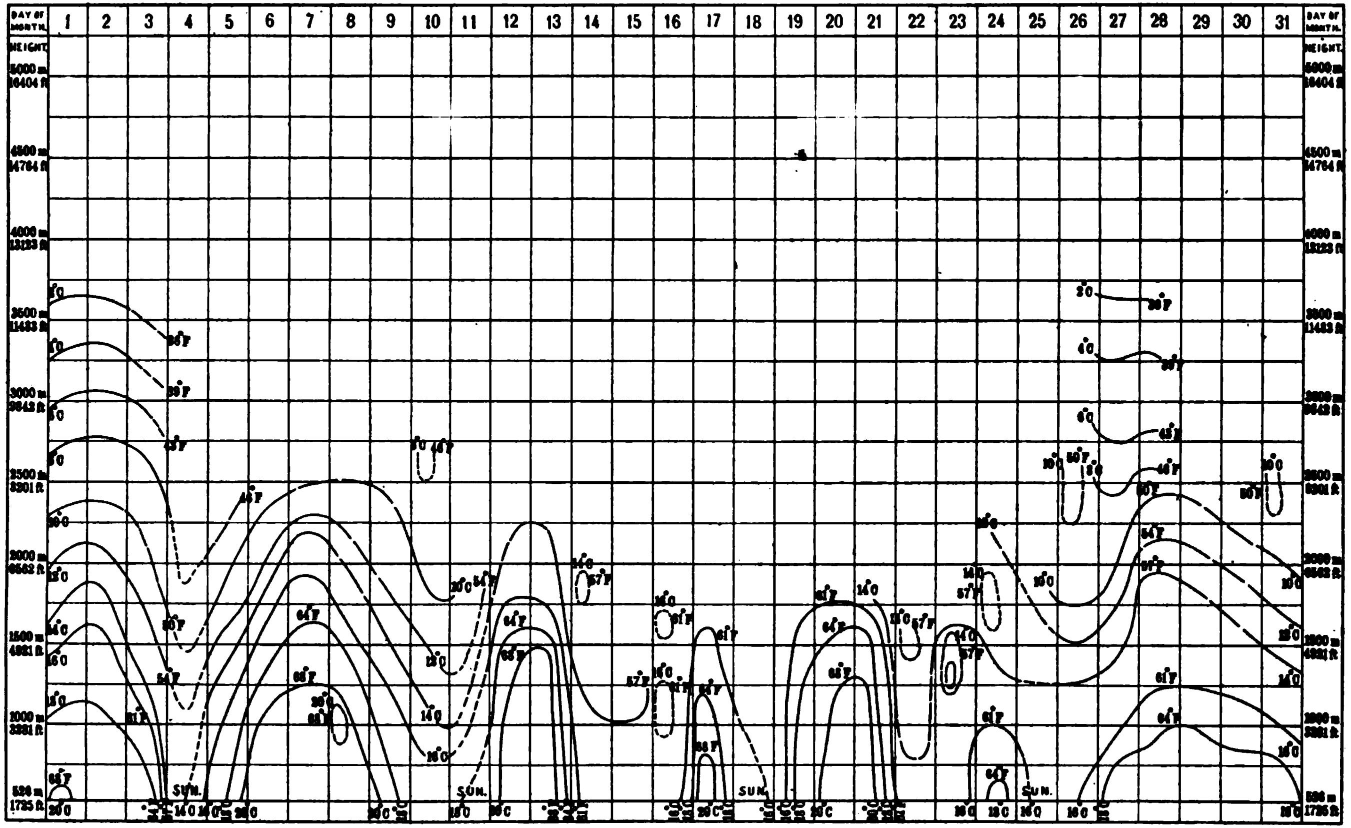
ingly such readings as were secured in that region, whatever the hour, were also used as of the hour 8 a. m. When the kite flight or balloon ascension was made in the afternoon the surface temperature at the morning hour was plotted on the charts and a correction, depending on the hour, the altitude, and the general character of the day was applied to the readings below 1,500 meters to reduce them to the probable value for the morning hour.

The charts purport to show, therefore, the temperature at the surface of the ground at about 8 a. m. each day, also the probable temperatures aloft at the same hour. Inversions are indicated by dotted lines and interpolated values by broken lines.

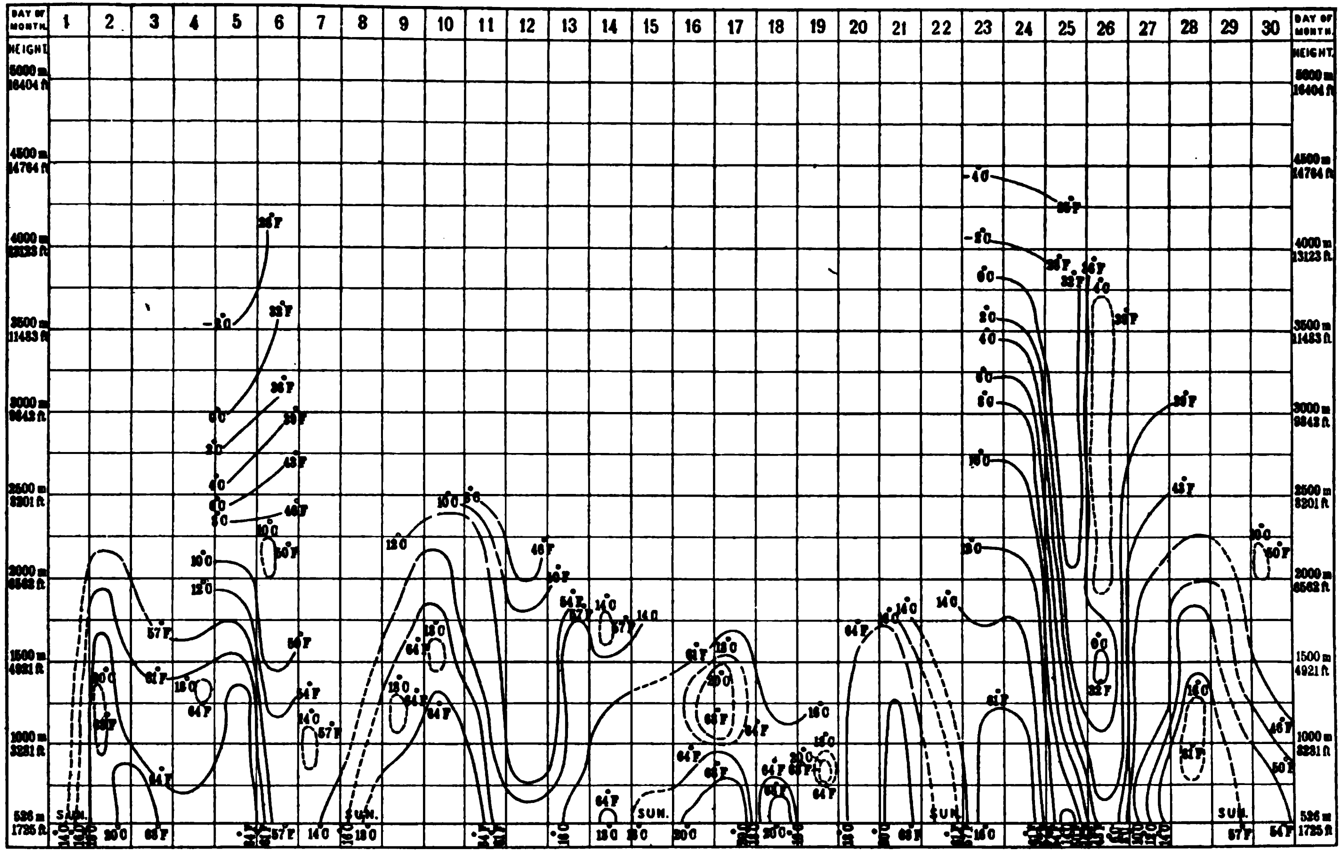
Chart IV.



Upper air isotherms (8 a. m.), July, 1907.



Upper air isotherms (8 a. m.), August, 1907.



Upper air isotherms (8 a. m.), September, 1907

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U. S. DEPARTMENT OF AGRICULTURE

Vol. I **BULLETIN** Part 2

OF THE

MOUNT WEATHER OBSERVATORY

William J. Humphreys, Ph. D., Director
William R. Blair, Ph. D., Assistant Director

PREPARED UNDER THE DIRECTION OF
WILLIS L. MOORE, D. Sc., LL. D.
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CONTENTS.

THE CHANGE OF PHASE DUE TO THE PASSAGE OF ELECTRIC WAVES THRU THIN PLATES AND THE INDEX OF REFRACTION OF WATER FOR SUCH WAVES, WITH APPLICATIONS TO THE OPTICS OF THIN FILMS AND PRISMS.

By William R. Blair.

INTRODUCTION.

Prof. A. Righi in his Optik der Elektrische Schwingungen describes numerous experiments with short electric waves tending toward the proof of the analogy of these with light waves. The disturbance proceeding from a Righi exciter is analogous to a plane polarized ray of white light, and the different wave-lengths, instead of being detected by their color, are known by the dimensions of the receiver which responds to them. Accurate measurements of these wave-lengths are made with either the grating or the interferometer. In addition to Righi's work, Lampa's experiments with grating and spectrometer,[1a] Cole's application of Fresnel's formulas,[2] Pierce's measurement of indices of refraction by the interferometer method,[3] etc., all seem to justify the assumption of the analogy above referred to and its use in extending our knowledge of optics as well as in the study of electric waves. The following experiments, upon which work has been in progress for the past two and one-half years, and their discussion are in line with this assumption, and, as will be seen by the description of the apparatus, ingenious devises, used here in more or less modified form, have been borrowed from all the experimenters named.

There is fairly good agreement among the values found for the specific inductive capacity of water, except those by Drude,[4] in the determination of which he used about the same wave-length as that used in the following experiments, and those by Lampa[1] for wave-lengths of 4, 6, and 8 mm. In both of these cases the values given for the index of refraction increase with the decrease in the length of wave used, apparently indicating anomalous dispersion. Drude's measurements were with waves on wires; Lampa used a 4° prism. Drude[5] has treated these results theoretically, adapting the theory of dispersion from Chapter V of his text-book on the Theory of Optics. His expla-

[a] All references appear at the end of the article.

nation is not easy to accept when the extremely slow frequencies of even the shortest electric waves used compared with those of light waves are taken into consideration.

In his work on the Indices of Refraction of Metals,[6] in which he uses thin metallic prisms, Prof. A. Kundt passes the subject of variable change of phase with the remark that "If the refracting angles are correctly measured by reflection, the observations of deviation can hardly be falsified by variable change of phase."

All work in which optical methods are used on the thickness of thin liquid films has been done on the assumption that n, the index of refraction, as computed by the usual formulas is the same for any thickness of the dielectric. The assumption that n for a given wave-length does not vary with the thickness of the plate is probably correct, but since, as will be shown later, the change of phase is not a linear function of this thickness, other than the usual formulas must be employed for computing n from the experimental data. The experiment upon the paraffin plates was taken up with the hope of testing the existence of this "variable change of phase," but the apparent failure to get positive results led to the setting aside for the time of the problem.

Altho the results of Mr. Cole's[7] attempt, in which he used electric waves of 5 cm. length, to get measurable effects thru a plane parallel plate of water gave little hope of success, the object at first of the experiment with water was to determine its index of refraction n by the interferometer method. The finding of different values of n, when computed by the usual formulas, for different thicknesses of the plate led to further work, the additional purpose of which was a quantitative determination of the variable change of phase.

PART I.

In the process of repeating some of the work already done with electric waves, a fairly reliable interferometer of essentially the form used by G. Pierce,[8] of Harvard, was set up. Fig. 1 shows the arrangement of this interferometer. It will be noted that the receiver R is influenced by the direct radiation from the gap G as well as by the parallel rays from the parabolic cylinder P, and by the energy reflected from the dielectric D as well as by that reflected from the plane mirror M. The direct radiation from G is a constant as is also the energy reflected from D, provided its position remains unchanged during the experiment upon it. The wave-length used was 15.2 cm. An electrolytic interrupter of frequency above 2,000 was used, which, while it

was not as constant as could be desired, gave steadier galvanometer deflections and considerably more energy than the ordinary vibrator. The plane mirror M is movable parallel to itself. The galvanometer used was a four-coil instrument of the Thomson type. Galvanometer readings are taken for different positions of the mirror, which when plotted give a sinusoidal curve. The maxima and minima of this curve are due to the interference of the reflected with the incident radiation and the distance between any two minima is half a wave-length. The introduction of the dielectric D moves these maxima and minima up a distance depending upon its index of refraction and thickness. It is not always possible to recognize a given maximum or minimum after it has been displaced. This necessitates an assumption as to the number of half wave-lengths it has been moved up and consequently a previous rough determination of the index of refraction. For work to which it is well adapted this apparatus is capable of duplicating results to 1 per cent.

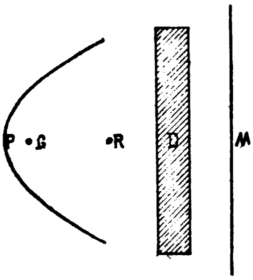

Fig. 1.

Conversation with Professor Millikan at this time (June, 1905) as to the possible uses to which this apparatus might be put, suggested among other things the problem of the change of phase due to thin films. This problem, it seemed, could easily be experimentally treated for electric waves of 15 or 20 cm. length, since the chief difficulty of the optical treatment, i. e., getting a sufficiently thin and uniform film of known thickness, disappears for this wave-length. Work was accordingly begun with paraffin as the dielectric. Previous work with a prism gave 1.47 for the index of refraction of paraffin. This value is the mean of five determinations, the highest of which is 1.48, the lowest 1.46. The prism had a refracting angle of 60°. Each face was 50 cm. wide by 20 cm. high. The same paraffin used in the prism was used in the interferometer experiment.

Ten plane parallel plates of the order of $\lambda/10$ in thickness and a plane parallel block of thickness approximating a wave-length were made as follows: (1) Sufficient paraffin for all castings was melted in one vessel; (2) as soon as possible after pouring the molten paraffin into the form it was immersed in a salt-ice-and-water freezing mixture; (3) using a plane surface, a straightedge, and a carpenter's plane, the castings were made into plane parallel plates. The plates were large enough to extend 2 cm. each way beyond the opening of the parabolic cylinder. This opening was 30 by 31 cm. Their thicknesses in mil-

limeters as measured by means of a pair of outside calipers were as follows:

Thickness of plates, in millimeters.

Plate No.	Measured separately.	Measured together.	Means.
1	8.0		
2	7.5		
3	7.9		
4	5.8		
5	7.3		
Totals Nos. 1-5.	36.5	37.1	36.8
6	7.5		
7	6.8		
8	6.5		
9	6.4		
10	5.0		
Totals Nos. 1-10.	68.2	69.4	68.8
Block.	63.6		63.6

These plates were mounted 1.25 cm. apart. Two measurements of the index of refraction were taken with ten plates, one with the first five and one with the block. The results are as follows:

10 Plates	1.55
	1.55
5 Plates	1.56
Block	1.50

Since the difference between these values and those obtained by the spectrometer method as well as that between the block and the plates might possibly be due to the fact that the thinner plates freeze under somewhat different conditions from the thicker, a change of phase could hardly be argued from these data alone.

Further experiment with the same apparatus showed that a sufficient effect could be obtained thru 4 cm. of water to determine its index of refraction, provided an assumption, $n = 80$, were made as to the number of half wave-lengths a given minimum in the curve showing the interference effect was moved up when the dielectric was put in place.

In order to avoid the necessity of this assumption, a vessel was made of which one of the sides was movable parallel to itself by means of a screw of 11 threads per inch (4.4 per cm.). The plan was to move the plane mirror so as to keep the path of the waves in air constant and, by varying the path in water, to find the wave-length in water. The resulting interference curve was apparently quite irregular but could

be qualitatively repeated. The position of its first maximum and minimum indicated a considerably shorter wave-length in water at 1.1 and 2.1 22ds of an inch (1.3 and 2.4 mm.) than that given by the assumption of $n^2=80$ at 17° C. This variation could not be followed with certainty farther than the first maximum and minimum and that far only qualitatively on account of irregularities evidently due to other causes. A possible variation in the amount of the reflected energy with the thickness of the water plate suggested itself and made some other form of interferometer desirable.

On consideration of these results, Professor Michelson thought further pursuit of the experiment with more elaborate apparatus worth while, suggested the trial of other forms of interferometer, and advised that paraboloids instead of parabolic cylinders be used as reflectors.

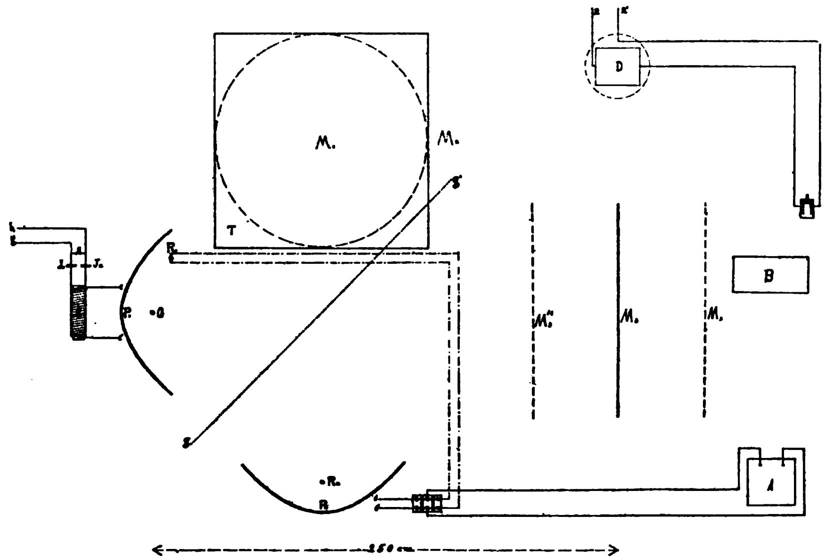

FIG. 2.

The apparatus decided upon was in the form of a Michelson interferometer (fig. 2). The collimating and focusing paraboloids P_1 and P_2 have each a focal length of 17.75 cm. and an opening of 90 cm. in diameter. The screen SS' for dividing the radiation is 122 by 183 cm. in size and composed of parallel wires. To make this screen a number 22 copper wire was thrown over the heads of tacks at the top and bottom of a wooden frame. After a few trials the wires were put 5 cm. apart. The movable plane mirror M_2 is a circle 122 cm. in diameter.

It is mounted on parallel ways and moved by means of a screw of millimeter pitch and 131 cm. in length. On the other arm of the interferometer, an elliptical plane mirror M_1, 122 cm. wide and 173 cm. long, is set at an angle of 45° with the vertical and throws the radiation down thru the liquid dielectric to a horizontal reflector M_2. All reflectors, except the horizontal ones on which zinc was used, are made of wood covered with a heavy grade of tin foil. Care was taken in their construction to get them plane and to guard against warping.

The path of the waves thru the interferometer from gap to receiver is about 6 meters—so great that when the wave producing and receiving apparatus which had given galvanometer throws as desired up to 30 cm. in the old interferometer was installed in this, the largest deflection obtainable at a meter distance in the maximum of the interference effect was 5 cm. While the energy furnished was sufficient to show the interference and measure the wave-length, no effects at all could be obtained thru water. After two or three months of experimenting, the following apparatus and methods of manipulation were decided upon as satisfactory, the test being the duplication of results to, in most cases, 1 per cent, in others, more or less depending on the thickness of the dielectric used.

The spark gap (fig. 3) consists of two balls of aluminium, B_1 and B_2, so mounted in a triangular frame that the space between them can be filled with oil and their distance apart adjusted to .05 mm. or less if desired. The upper ball was mounted on a spindle so that it could be turned to a freshly polished place without changing its position. The lower one was put in a cup, which in turn was fitted into the frame by means of threads of millimeter or half millimeter pitch, depending on the diameter of the cup. This cup also contains the oil or other dielectric in which it is desired that the sparking shall take place. It was found, however, that the energy from a spark between freshly polished surfaces diminished quite perceptibly as the surface became worn and that the spark from the surfaces made rough by sparking, while it was weaker, was a much more constant source of energy. Had it not been for the great number of readings, about 20,000 in all, required by the experiment, the rotation of the balls would not have been necessary.

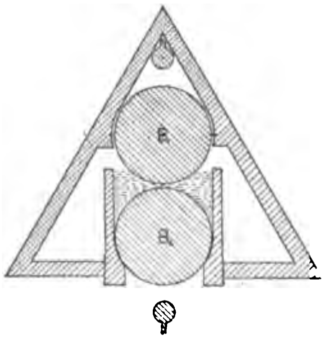

FIG. 3.

To adjust the gap the balls were set at some distance apart, say 2 mm. and then moved closer together a given fraction of a millimeter at a time, galvanometer readings being taken at each point. From a plot of the relation between the width of the gap and the energy given out by it, the best width was easily determined. This width was found to vary with the shape of the electrodes producing a given wave-length. For the electrodes used in this experiment it was found to be about one millimeter. A gap intended for long use was set at a width slightly below that giving the maximum amount of energy. During the taking of readings for the above curve, the plane mirrors were equidistant from the screen, and the width of the gap was the only thing about the interferometer which was varied. Vaseline oil was used. The three sizes of balls used were 2, 4, and 8 cm. in diameter. The circuit formed by the two balls about the oil gap was connected by means of two air gaps, each about 7 or 8 mm. wide, with the half-inch balls forming the terminals of the secondary circuit of a sort of Tesla coil, which in turn worked on the secondary of a 14-inch induction coil.

The primary of the Tesla coil consisted of 37 turns of bare number 14 copper wire wound on a glass tube 7.5 cm. in diameter and 25 cm. long. A sliding contact was used to vary the induction in this circuit and any desired capacity could be introduced. Any suitable secondary circuit could be slipped inside of this primary. The secondary used consisted of 22 meters of number 19 bell wire wound in a single layer on a glass tube 6 cm. in diameter and 27 cm. long. The connecting wires made this circuit 25 meters in length. For connections, see fig. 2, in which b and b' are the wires coming from the secondary of the induction coil. A current of air was passed thru each of the three air gaps, made necessary by these connections, after each reading in preparation for the next. This put the gaps in the same condition before each reading and added materially to the constancy of the throws for any given position of the plane mirrors. Two Leyden jars and 15 turns of the primary were used for the 25 meter secondary.

A mercury turbine interrupter run at a frequency of 50 was used in the primary of the induction coil. The $\frac{1}{12}$ H. P. motor running this interrupter was kept well oiled and ran on a 110-volt circuit, which rarely varied by more than a volt during any set of readings. To secure this constancy of voltage, readings had to be taken between 1 and 5 a. m.—i. e., at the time when there was no variable load on the generator supplying the current. Conditions were also much

better at this time for satisfactory use of the galvanometer, the earth's field being almost entirely free from disturbance and the building from vibration. The interrupter itself was frequently cleaned to prevent the possibility of poor contacts due to deposits of either carbon or oxide of mercury on the terminals of the primary inside the interrupter.

The primary of the induction coil was further interrupted at D by a pendulum 410 cm. long. The pendulum struck a trigger which put the make and break under control of a spring, insuring not only the same sort of make and break, but the same length of contact for each reading of the galvanometer. Experiment with different times and sorts of contacts showed the necessity of such a device as the above and results amply justify its use.

It was thought that preventing the direct radiation from the gap from entering the interferometer added somewhat to the symmetry of the interference curve. This was done by means of a spherical mirror large enough to extend 2 or 3 cm. beyond the gap circuit, and so placed as to have the gap at its focus.

The dividing screen was made adjustable as follows: Number 28 copper wires were fastened at regular intervals to a helical brass wire spring which was slipped over a brass tube. Varying the tension on the spring varied the distance apart of the wires. Each wire is stretched and kept in position by a lead bullet cast on its lower end. A curve is plotted representing the relation between the distinctness of the interference and the distance apart of the screen wires. The distinctness of interference is found by taking the difference between the galvanometer throw at a given maximum and that at the adjacent minimum. The point of maximum distinctness can in this way be determined and the wires set accordingly. The distance apart of the wires in this experiment was from 6 to 7 cm.

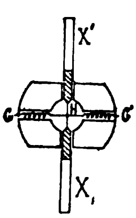

FIG. 4.

Two receivers were used, one of which R_1 was so placed as to receive the direct radiation from the gap; the other R_2 the radiation after the interference has taken place. These were thermal receivers of the Klemincic type and like those used by Mr. Cole.[7] Fig. 4 shows the construction of a receiver. G and G' connect with the galvanometer. H is the thermal junction. The wires used for the thermal junction were iron and constantan and had a diameter of 0.001 inch. Round wires of this size could not be obtained from any of the several companies applied to for them, consequently the wires were ground down from 3 mill wires. An apparatus for this

purpose was constructed which stretched the wire and rotated it at a desired speed. The wire was reduced by the application of fine emery paper. Receivers made from these wires were thought to be more sensitive than those constructed from wires having elliptical sections of the same area. No quantitative test, however, of this point was made.

X and X', fig. 4, are copper cylinders which may be slipped off and on the electrodes of the receiver and serve for its tuning. The method of tuning is that described by Mr. Cole.[7] A curve is plotted of readings taken for different lengths over all of the receiver. This curve has but one maximum, and it corresponds to that length of receiver best adapted to the gap. Considerable importance attaches to careful tuning if distinct interference effects are desired.

R_1 and R_2 are connected to the same galvanometer so as to oppose each other. The amount of energy received by R_1 may be varied at will by varying its distance from the gap or by changing its dimensions. It is so adjusted that the galvanometer system swings as far to the right at a given minimum due to interference as it does to the left at the succeeding maximum. Several important results are accomplished by this arrangement. Instead of throws varying from 1 or 2 cm. at the minima to 25 or 30 at the maxima, throws of -5 or -6 cm. at the minima and $+5$ or $+6$ at the maxima are obtained. A curve plotted from readings of the first sort has a nonsymmetrical appearance, the maxima being sharper and less regular than the minima, while for the second sort a smooth sinusoidal curve is obtained in which maxima and minima have the same shape and are alike easily determined. The interference curve is plotted with reference to the line representing the direct radiation from the gap, in this way eliminating to a considerable extent irregularities in the readings due to small variations in the amount of this energy. The extent of a given galvanometer throw is so reduced as to be within the limits for which the throw is proportional to the steady deflection without a sacrifice of distinctness in the resulting plot of these throws.

The galvanometer is so adjusted that a throw takes place in a little less than the time of contact as controlled by the pendulum (about two seconds), and throws rather than permanent deflections are read, because they can be taken more rapidly and with less wear of the gap. In order to reduce these throws to permanent deflections for purposes of comparison, it was planned to determine empirically a plot of the relation existing between a series of throws from 0 up to 25 or 30 cm. and their corresponding deflections. This was done by means of a

dry cell and variable resistance in circuit with the galvanometer and the pendulum make and break. The ratio of the permanent deflection to the throw remained constant for wider limits than had been anticipated, so that the use of two receivers as described above obviated the necessity of the reduction. The ratio for the galvanometer used was 0.66. Care was taken in the disposition of coils and lead wires that their magnetic fields should not affect the earth's field at the galvanometer.

Preliminary experiment with the trough for containing the dielectric showed that wood, beeswax, and glass reflected enough energy to give quite distinct interference, i. e., their effects could not be neglected in comparison with water or metals and had to be eliminated. It also appeared that the reflection from a thin plate of water varies with its thickness, being greatest at $\bar{\lambda}/4$ where λ is the wave-length in water assuming $n=8.92$; and that on account of variation in the amount of energy transmitted by such a plate with its thickness, the water-beeswax, water-glass, etc., surfaces gave varying reflections.

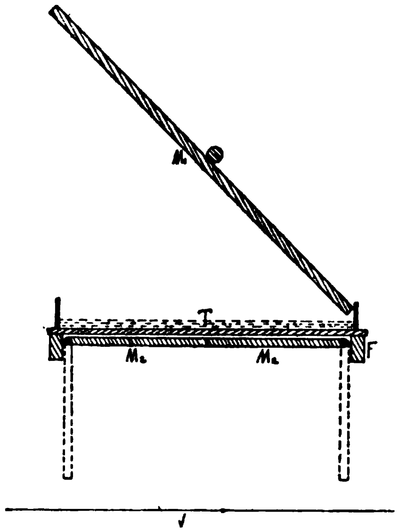

FIG. 5.

Elimination of these variable effects was accomplished by the construction of a glass trough and mirrors arranged as shown in fig. 5, which is a cross-section of the reflectors on this arm of the interferometer. M_1 is the elliptical mirror placed at an angle of 45° to the horizontal. T is the glass trough 116.75 by 116.70 cm., an almost square bottom, and 10 cm. deep, sides being at right angles to the bottom. The bottom of the trough is of selected half-inch plate glass, special attention being given to uniformity of thickness and planeness of surface. The sides are of quarter-inch glass, also selected plate. The frame F on which the trough rests is mounted on three leveling screws, so that using a delicate level a sufficiently horizontal surface could be obtained on which to spread uniform plates of the dielectric. The amount of water required for a plate of given thickness was determined to more than the required accuracy by weighing. The M_2's are the horizontal reflectors—planes of wood each about 60 by 120 cm.,

covered with sheet zinc and hinged so that they can be dropt out of the path of the radiation if desired.

The bottom of the trough is 81 cm. from the floor—far enough so that no interference effect could be obtained from the floor within the range of the effects being studied. This is easily seen if we consider

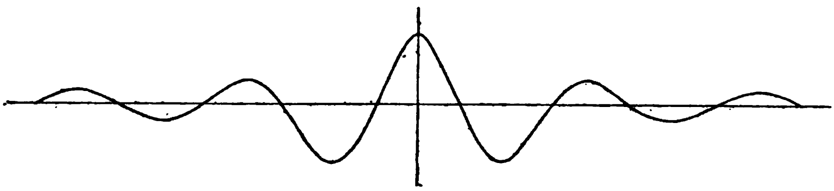

FIG. 6.

a characteristic curve of interference (fig. 6). The highest maximum occurs when the plane mirrors are equidistant from the screen. Four distinct maxima and as many minima may be located on either side of this maximum. Beyond this the effects become less distinct and the curve approaches a straight line. Now (since the distance between two neighboring maxima is $\lambda/2$) for $\lambda=20$ cm. the maximum effect due to reflection from the floor would occur at a distance of 20 maxima farther out than the maximum effects due to reflections from the horizontal mirrors.

In what follows the phase change will be defined as the total displacement of a given maximum or minimum of the above curve due to the introduction of the dielectric into the path of the radiation. This has heretofore been, in all work with prisms and on the measurement of thin films, assumed to be a linear function of the thickness of the dielectric.

The method of determining the change of phase due to a given thickness of the dielectric is as follows: (1) Determine the position of the maxima and minima on the interference curve before introducing the dielectric. This requires two sets of readings. The first is taken with the horizontal mirrors in position. In this case the interference is due to reflection of energy from three surfaces—the upper and lower glass surfaces and the zinc surface. The horizontal mirrors are swung down and the second set of readings taken. This set shows interference due to reflection from the upper and lower glass surfaces. Subtracting this second set from the first gives the position of maxima and minima due to reflection from the zinc surface alone. These positions are determined by making a plot of the differences. (2) Introduce a

known thickness of the dielectric and proceed as above. This time the first set of readings contains the four elements—reflection from the water surface, the water-glass surface, the lower glass surface, and the metal. The second set contains the first three of these elements, and as before subtraction of the second set from the first gives the interference effect due to the energy which has traversed the dielectric to and from the zinc mirror. The maxima and minima are located as before. The phase change is the mean distance between the two sets of positions thus determined.

In this experiment five points were determined for each thickness of the dielectric—the principal maximum and one maximum and a minimum on either side of it. A set of readings is taken as the movable mirror is moved in and out, i. e., toward and away from the screen, thru a sufficient distance for the determination of the five positions referred to above. Readings are taken a centimeter apart for a wavelength of 20 cm., more or less for a longer or shorter wave. A sample determination of the phase change is shown in Table 1. The waterplate is 12 mm. thick and $\lambda = 19$ cm. in air.

TABLE 1.

Position.	Throws from H_2O, glass and metal (1).			Throws from H_2O, and glass (2).			(1)−(2).	Maximum and minimum.	Maximum. and minimum.	Phase change.
	In.	Out.	Mean.	In	Out.	Mean.				
49	−19.0	−18.8	−18.9	− 4.0	− 4.0	− 4.0	−14.8		No	
50	−41.8	−87.5	−89.6	−82.9	−28.0	−30.0	− 9.6		H_2O	
51	−58.8	−56.0	−57.4	−57.0	−63.0	−60.0	2.6		in	
52	−59.8	−58.0	−56.4	−69.0	−86.0	−77.5	21.1		trough.	
53	−55.5	−51.2	−53.8	−82.0	−66.5	−74.2	20.9	52.7	42.8	9.9
54	−44.0	−84.0	−89.0	−52.0	−46.0	−49.0	10.0			
55	−80.0	−29.5	−29.7	−23.0	−25.0	−24.0	− 5.7			
56	−20.5	−25.2	−22.8	− 2.0	− 8.8	− 2.9	−19.9			
57	−29.2	−28.5	−26.8	7.0	10.0	8.5	−34.8			
58	−30.5	−82.0	−81.2	− 8.0	− 2.2	− 2.6	−28.6	57.5	47.6	9.9
59	−35.5	−32.0	−33.7	−24.0	−17.8	−20.9	−12.8			
60	−37.0	−85.9	−86.4	−36.0	−87.5	−36.7	0.3			
61	−37.0	−33.8	−35.4	−52.0	−58.8	−55.4	20.0			
62	−40.0	−88.5	−39.2	−72.5	−68.0	−70.0	31.0	62.4	52.4	10.0
63	−40.0	−41.0	−40.5	−51.2	−58.0	−54.6	14.1			
64	−31.8	−83.2	−82.5	−41.5	−40.0	−40.7	8.2			
65	−32.0	−84.0	−88.0	−27.6	−28.7	−25.6	− 7.4			
66	−39.5	−40.2	−89.8	−16.0	−10.0	−13.0	−26.8			
67	−36.5	−40.5	−88.5	−16.0	− 7.2	−11.6	−26.9	67.2	57.2	10.0
68	−43.0	−38.0	−40.5	−16.0	− 6.7	−11.3	−29.2			
69	−36.8	−37.5	−37.1	−24.5	−17.0	−20.7	−16.4			
70	−31.5	−31.0	−31.2	−37.5	−30.0	−33.7	2.5			
71	−36.2	−34.5	−35.3	−40.5	−46.0	−43.2	7.9			
72	−38.0	−85.5	−86.7	−52.0	−60.0	−56.0	19.3	72.1	61.9	10.2
73	−33.0	−30.5	−31.7	−48.0	−40.0	−44.0	12.3			
74	−34.5	−31.8	−33.1	−39.0	−34.0	−36.5	3.4			
75	−32.8	−40.0	−36.4	−28.0	−25.5	−26.7	− 9.7			
76	−33.0	−41.0	−37.0	−25.0	−15.0	−20.0	−17.0			
77	−40.0	−44.0	−42.0	−20.0	− 9.0	−14.5	−27.5			
										1.2)10.00
										8.33

Such determinations as the above were made on plates of water of thicknesses varying a millimeter at a time up to 22 mm. and from there varying 2.65 mm. at a time up to 34.45 mm., with a wave-length of 19 cm. The results of these determinations are shown in Table 2.

TABLE 2.

Thickness of plate in millimeters.	1	2	3	4	5	6	7
$\frac{\text{Phase change}}{\text{Thickness of plate}}$	16.0	16.2	13.4	9.1	8.2	7.2	6.0
Thickness of plate in millimeters.	8	9	10	11	12	13	14
$\frac{\text{Phase change}}{\text{Thickness of plate}}$	6.62	7.10	7.62	8.14	8.33	8.60	8.60
Thickness of plate in millimeters.	15	16	17	18	19	20	21
$\frac{\text{Phase change}}{\text{Thickness of plate}}$	8.10	7.87	7.82	7.69	7.68	7.72	7.85
Thickness of plate in millimeters.	22	23.85	26.5	29.15	31.8	34.45	
$\frac{\text{Phase change}}{\text{Thickness of plate}}$	8.10	8.31	8.08	7.77	7.98	8.07	

Fig. 7 shows a plot of these results, the ordinates being the phase change per unit thickness of plate, the abscissas the thickness of the plate.

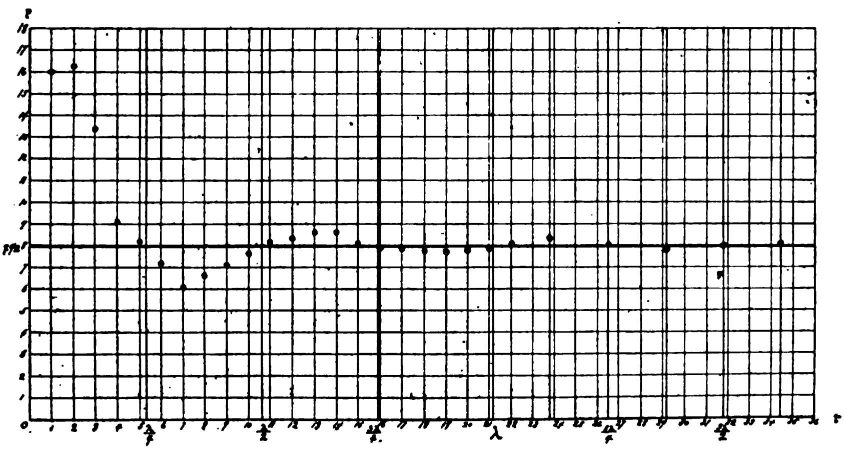

FIG. 7.

It is found that the mean curve crosses the ordinates $t = 5.3$, 10.6, 15.9, 21.2, etc., at about $p = 7.92$. The relation of the index of refrac-

tion n to the phase change per unit thickness of the plate p is given by

$$n=p+1$$

and may be deduced as follows: Let t be the thickness of the water plate, n the index of refraction, d_1 the distance from the screen to the fixt mirror, and d_2 the distance from the screen to the movable mirror. Then

$$d_1-t+nt=d_2$$
$$(n-1)t=d_2-d_1$$
$$n-1=\frac{d_2-d_1}{t}=p$$
$$n=p+1.$$

Taking 8.92 as the index of refraction of water and computing the wave-length in water from a mean of its determinations in air, 19.1, it is found that the ordinates, $t=5.3$, etc., occur at the quarter wave-lengths.

Since the phase curve continually approaches the straight line, $p=7.92$, 8.92 may be taken as the index of refraction of water for thicknesses such that the variation in p is negligible compared with the errors of experiment. At 3.445 cm. or $13\lambda/8$ thickness of the water plate this variation was found to be but little more than the error to which this work is liable. All measurements were made on distilled water at a temperature of about 19° C. No corrections have been made for temperature, and variations of ½° or less from this most convenient point have been disregarded. Values of n and K (the specific inductive capacity) for water are usually given for a temperature of 17° C. According to the determinations by Heerwagen,[3] also by Drude,[4] the correction to be applied for 2 degrees (amounting to about 1 per cent) brings the result of this determination to $K=80.4$ at 17° C.

If the points in fig. 7 be correctly located, it ought to be possible to construct a prism such that two or more angles of deviation could be obtained from it by using that part of the prism of thickness 2 mm. to 7 mm. for one determination, 7 mm. to 13 mm. for another, etc., in a spectrometer suitable for this wave-length.

Such a spectrometer was set up (fig. 8). Two like parabolic cylinders were used for collimating and focusing the rays. The slit afforded by one of these cylinders was 43 cm. wide and 52 cm. long. In the experiment this width was cut down to 35 cm. and the height

to suit the depth of the water in the prism, in order that all radiation reaching the focusing cylinder must first pass thru the prism. The latter cylinder was attached to an arm pivoted directly below the prism and carried an index which moved over the circumference of a circle of radius 79.2 cm. drawn about the pivot as a center. The prism was 1.3 cm. thick at a distance of 90.3 cm. from the refracting angle, which, computed from these dimensions, was about 0.83°. It was mounted with the face next the collimator perpendicular to the direction of the rays and so that, keeping this face in the same plane, it could be easily moved backward or forward.

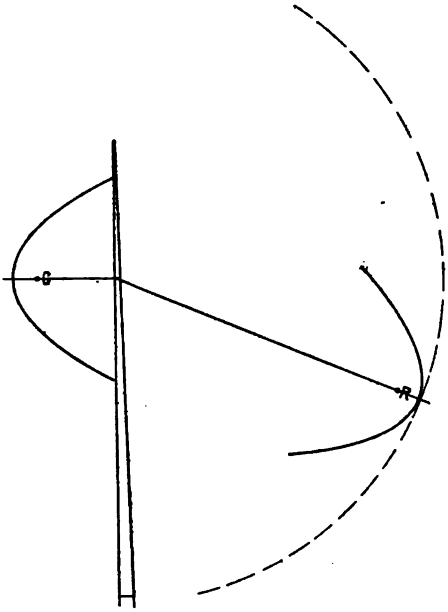

FIG. 8.

Readings were taken as follows: With the empty prism, the focusing cylinder was moved thru as large an angle as the mounting would permit (140°) in search of diffraction effects—none was found. The single maximum was noted. The prism was then filled with water and the maxima taken; one when the radiation past thru that part of the prism between the points of 2 mm. and 7 mm. thickness and the other between the points of 7 mm. and 13 mm. thickness. In the determination of these maxima, arbitrary divisions were marked on the circumference along which the focusing cylinder moved and the maxima located in terms of these divisions. The maxima were found at 10, 11, and 14, respectively. Measuring the divisions gave the following distances: 10 to 11, 26 mm.; 10 to 14, 106 mm. These distances correspond to 1.9° and 7.7°, respectively—the two angles of deviation obtained from the same prism.

A computation of the angle of deviation on the assumption of a uniform change of phase and the index of refraction found above give 6.6°. The error in the above determination does not exceed 30′ and arises from a lack of sharpness in the maxima. In the work with the paraffin prism the maximum could be found much more accurately.

These results seem to agree well with those given by the interferometer experiment.

To insure accuracy in the location of the points determining the phase curve, it is necessary, among other things, that the flow of energy from the gap be kept constant only during the taking of each set of readings. Constancy of this factor thruout the entire determination of the curve could not be so nearly realized. It was, however, sufficiently realized to give, in a general way, the relation between the thickness of the water plate and the amount of energy transmitted by it. The lower set of points (fig. 9) was determined from the curve showing the interference effects due to the transmitted energy. These points have for ordinates the differences in height between the principal maximum and the minima on either side of it, and for abscissas the thickness of the water plate used. It is obvious that since the energy has traversed the plate twice, the square roots of these ordi-

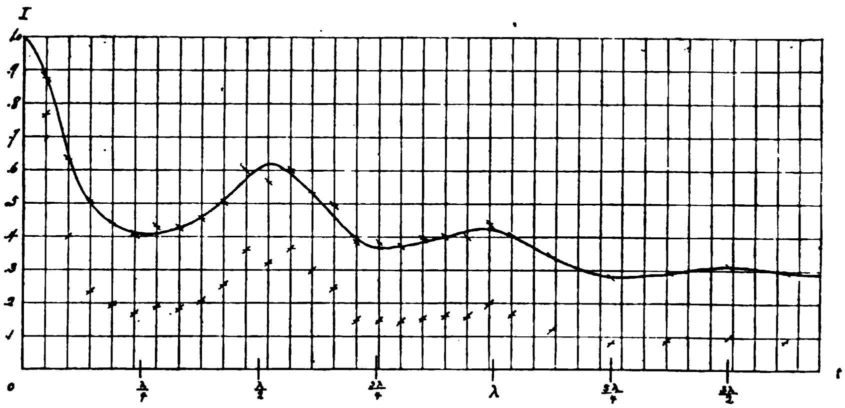

FIG. 9.

nates, taking that for the plate of zero thickness to be unity, gives the ordinates of the points on the curve showing the desired relation. This last operation is an approximation, depending on how nearly alike a water-air surface is to a water-glass surface in its reflecting power. As stated above, this curve is only a rough approximation compared to the phase curve, the determination of which was the prime object of the experiment.

It will be seen from this curve of energy transmission that minima occur at the odd quarter wave-lengths and maxima at the even, and that both maxima and minima decrease with the increasing thickness of the plate. The curve is introduced here to show at what points the phase curve is most reliably determined. Where the transmission is

least, the maxima and minima of interference effects are not so well defined. Since the quantity p to be determined is the phase change divided by the thickness of the plate, this lack of definition is productive of error in the numerator of the fraction. The error in p is also larger when the denominator of the fraction is small. Consequently the points for thickness of from 1 to 7 mm. are the least accurately determined. From 9 mm. out the error is not more than 1 per cent. This is, of course, assuming that no error is occasioned by accident, such as a slight dislocation of a reflector or a change of level of the trough, which might pass unnoticed during a set of readings. Precautions were taken against such errors, and while it is possible it is not probable that any occurred. An error of this sort would affect the location of usually one point only, never more than two, since the apparatus was inspected every day and the determination of one point, sometimes two, was all that could be accomplished in that part of the day in which conditions were favorable for taking readings.

Readings have already been taken with wave-lengths of 13 and 35 cm. which do not give accurate quantitative results because of unsatisfactory conditions arising from the necessity of heating the building. The variations of heat and pressure in the steam pipes interfered with the galvanometer and the temperature changes in the dielectric were too great to be neglected. These readings, however, give, for both longer and shorter wave-lengths, the same sort of curve as described above, and apparently point to no change in the value of n in this range of wave-length.

Following out the amount of energy reflected from the water surfaces, it is found as was to have been expected that the maxima of reflection occur at the same points as the minima of transmission and vice versa. The maximum at $\bar{\lambda}/4$ thickness of the plate is very pronounced, that at $3\bar{\lambda}/4$ much weaker. It is not probable that there is any variation in the energy reflected from the upper surface of the water, but at the odd quarter wave-lengths this is reenforced by the energy reflected from the water-glass surface while at the half wave-lengths it is cut down by interference. The variation in the amount of transmitted energy has a similar explanation.

The results of these experiments may be briefly summarized as follows:

1. The variation in intensity of both the transmitted and reflected energy is observed to be in accord with the formulas developed for similar optical effects. These formulas are found in the texts on optics.

2. The index of refraction of water as determined is 8.92, no indication being given of the anomalous dispersion found by Drude[4, 5] in the vicinity of the frequency, $1.5 \times 10.^9$

3. The change of phase per unit thickness of the dielectric due to the passage of electric waves thru thin plates is not a constant for varying thicknesses of the plate, but, when plotted, is a curve crossing the line, $p = 7.92$, at the quarter wave-length points and having decreasing maxima and minima, the slope at the odd quarters being negative, that at the even being positive. This is clearly shown by the experiment upon water and, if the paraffin in the prism and plates have the same index of refraction, by the experiment upon paraffin.

4. This variable change of phase manifests itself in the work with the thin prism as an apparent variation in the thickness of the prism and consequent variation of its refracting angle for different actual thickness. This seems to render unreliable all determinations of indices of refraction made with thin prisms, including the work of Kundt on metals and that of Lampa on water. The data obtained by these experimenters are not available for other interpretation than that put upon it by them unless it be known at just what thickness of the prism their observations were made, in addition to the data usually taken in spectrometer experiments.

This experimental work was completed at the Ryerson Physical Laboratory December 17, 1906. Theoretical considerations, the result of further study of the above data in connection with the author's work at Mount Weather, Va., follow in Part II, which will appear in the next number of this Bulletin.

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PYRHELIOMETER AND POLARIMETER OBSERVATIONS.

By H. H. KIMBALL.

COMPARISON OF PYRHELIOMETERS.

At the Oxford Conference of the International Union for Cooperation in Solar Research the following resolutions, among others, were adopted:

Resolutions concerning the measurement of solar radiation.[1]

1. In order to secure uniformity, it is desirable that observations on the intensity of solar radiation in different localities shall be made as far as possible with the same type of instrument.

2. That for the present Ångström's pyrheliometer be adopted as the standard instrument.

3. That it is desirable to obtain accurate comparisons between the records of Ångström's pyrheliometer and other standard instruments. * * *

The U. S. Weather Bureau has had one or more Ångström pyrheliometers in almost constant use since November, 1901,[2] and has made frequent comparisons, not only between different Ångström instruments, but also, thru the courtesy of the late Doctor Langley and with the cooperation of Mr. C. G. Abbot and Mr. F. E. Fowle, jr., between Ångström pyrheliometers and the actinometers employed at the Astrophysical Observatory of the Smithsonian Institution. Before discussing the radiation data that have been accumulated, it seems desirable to examine the results of these comparisons, in order that we may the better understand the present state of our knowledge of the value in absolute measures of radiation observations.

In his early description of his pyrheliometer[3] Ångström gives his reasons for believing that measurements with it may be exprest in absolute units with a probable error of less than 2 per cent, *assuming that the temperature of the strip exposed to direct solar radiation is the same as the temperature of the strip warmed by the passage of an electric current thru it.*

[1] Transactions of the International Union for Cooperation in Solar Research. Vol. I, p. 231.

[2] For previous summaries of results, with description and discussion of the instruments, see "Observations of solar radiation with the Ångström pyrheliometer," by Harvey N. Davis and H. H. Kimball, reprinted from the Monthly Weather Review for June and July, 1903, Vol. XXXI, pp. 275 and 320. Also "Variations in isolation and in the polarization of blue sky light during 1903 and 1904," by H. H. Kimball, Proceedings of the Third Convention of Weather Bureau Officials, p. 69.

[3] Astrophysical Journal, Vol. 9, p. 332.

Letting Q = the rate at which radiation is being received,
a = the absorbing power of the surface exposed to radiation,
b = the width of the strips,
r = the mean resistance of the strips in ohms per cm., and
i = the strength of the compensating current in milamperes,
then $Q=\frac{60\,ri^2}{4.19\,ba}$ gram-calories per minute per cm.^{2} of normally exposed surface $= ki^2$.

With respect to the accuracy with which the values of the several terms in the above equation are known, Ångström states that since the strips are cut out on a dividing engine the width b is known within 0.5 per cent, even after the strips have been coated with lamp black; that from careful determinations it is believed that a is known to within 0.5 per cent, and that the error in the determination of r does not exceed 0.3 per cent.[4] He therefore concludes that errors caused thru db, da, and dr will amount at most to 1.3 per cent. Furthermore, since the strength of the compensating current can be determined without difficulty to within 0.3 per cent, and the resulting error in Q would not be greater than 0.6 per cent, the total error in a single determination of Q would amount at most to about 2 per cent, of which 1.3 per cent is a constant error and 0.6 per cent is accidental. This conclusion as to the accuracy of his instrument Angström reiterated[5] at the Oxford meeting of the International Union above referred to.

Ångström's confidence in the accuracy of his pyrheliometer appears to have been shared by Viole,[6] who also cites important theoretical investigations in support of the principles involved in this instrument.

Callendar[7] found that an absolute bolometer designed by himself gave results only one per cent higher than an Ångström pyrheliometer with which he compared it. He states, however, that the values given by the two strips of the pyrheliometer differed by nearly 15 per cent, and that the mean value by this pyrheliometer was 7 per cent higher than the value of the radiation obtained from another Ångs-

[4] This applies to platinum strips, whose resistance increases with the temperature, and, hence, both with increase of air temperature and with strength of current. The error should be smaller for manganin strips, since the temperature coefficient, being zero, does not enter into the determination.

[5] The "Compensating pyrheliometer," by Knut Ångström, Transactions of the International Union for Cooperation in Solar Research, vol. 1, pp. 178–180.

[6] Report on radiation by M. J. Viole. Report of the Int. Met. Com., Southport, 1903, p. 91.

[7] Report on the total solar eclipse of 1905, August 30. Report of the Expedition to Castillón de la Plana, Spain. Part II. By Prof. H. L. Callendar, F. R. S. Proc. Royal Soc. vol. 77, No. A, 514, p. 6.

tröm pyrheliometer with which he made simultaneous readings later. At the same time he points out that pyrheliometers with platinum strips may give results that are too low, due to the fact that the values of r, and consequently of k, increase with the temperature of the strips, as is shown in the following tabulated values of k:

Temperature C.	−10°	0°	10°	20°	30°	40°
			k			
Pyrheliometer No. 28	7.80	7.83	7.87	7.90	7.94	7.97

A black-bulb thermometer, the bulb of which extends inside the tube containing the strips, but which is not exposed to direct radiation, is used to determine the temperature of the strips. In reality it gives the temperature of the air inside the tube, which may be several degrees lower than the temperature of the strips. Callendar found that the temperature of his bolometer strips was 20° C. above the temperature of the air surrounding them. A like excess in the temperature of the pyrheliometer strips over the temperature indicated by the black-bulb thermometer would introduce an error of 1 per cent in the indications of the pyrheliometer, and would account for the difference between the readings of Callendar's absolute bolometer and the Angström pyrheliometer directly compared with it.

It is stated that the intensity of radiation in absolute measures, as indicated by Callendar's absolute bolometer, was determined by observing the value of the electric current required to produce the same rise of temperature in the grid as the radiation to be measured. Details are, however, lacking, so that it is impossible to form an opinion as to the accuracy of this method of standardization.

TABLE 1.—*Comparison of Angström pyrheliometers (Chistoni).*

Date.	Pyrheliometers.	Results.	Remarks.
June 30, 1902	No. 39 and No. 19	In accord.	No. 39 was in constant use from June 25, 1902, to April, 1904, when No. 19 was substituted for it.
July 1, 1902	No. 39 and No. 19	In accord.	
Aug. 24, 1902	No. 19 and No. 38	In accord.	
Aug. 25, 1902	No. 19 and No. 38	In accord.	
Aug. 26, 1902	No. 19 and No. 38	In accord.	
Feb. 18, 1903	No. 39 and No. 29	In accord.	
Mar. 24, 1903	No. 39 and No. 29	In accord.	
May 9, 1903	No. 39 and No. 19	In accord.	
May 22, 1903	No. 39 and No. 19	In accord.	
May 26, 1903	No. 39 and No. 19	In accord.	
May 29, 1903	No. 39 and No. 19	In accord.	
July 11, 1903	No. 39 and No. 29	In accord.	
July 12, 1903	No. 39 and No. 29	In accord.	
Oct. 7, 1903	No. 29 + No. 39	1.064	The strips on No. 39 separated between June 25, 1902, and September 27, 1903.
Oct. 21, 1903	No. 19 + No. 39	1.048	The appearance of the absorbing surfaces of No. 19 had changed, but the strips had not separated.
May 2–29, 1904	No. 29 + No. 19	1.118	
June 17–24, 1904	No. 39_{bis} + No. 19	1.112	No. 39 had been provided with new manganin strips and was renumbered 39_{bis}.
June 16–29, 1904	No. 39_{bis} and No. 29	In accord.	

Among the extensive comparisons that have been made between different Ångström instruments may be mentioned the series by Chistoni,[8] which is summarized in Table 1. From this summary it appears that while Nos. 19, 29, 38, and 39 were in accord in 1902, No. 29 read higher than Nos. 39 and 19 in October, 1903, and read 11 per cent higher than No. 19 in May, 1904. Comparisons between Nos. 29 and 39_{bis} in June, 1904, indicate that the former had undergone no change. The separation of the strips that occurred in No. 39 is a defect to which the Ångström pyrheliometers as first constructed were quite liable, and which the maker appears to have remedied in the instruments of more recent construction. It is not clear, however, why this should cause the indications of the instrument to be too low. Furthermore, Chistoni states that it was not the defect that caused No. 19 to read low. It is to be noted that all these instruments were in accord when first received.

TABLE 2.—*Description of Angström pryheliometers used by the Weather Bureau.*

Instrument.	Constants.					Remarks.
	r	b	a	c*	k†	
No. 28........	0.0810	0.150	0.98	0.00045	7.90	Received in August, 1901. In continuous use at Providence, R. I., and at Asheville and Black Mountain, N. C., from November 1, 1901, to March 26, 1903. In April, 1903, it was noticed that the platinum front of one of the strips had separated at the center from the copper strip back of it. Shortly afterwards this strip was accidentally ruined.
No. 31........	.0781	.150	.98	.00045	7.13	Received in August, 1901. Has been used but little and is still apparently in good condition.
No. 34........	.0751	.152	.98	.00045	7.22	Received in August, 1901. Was in continuous use from April, 1903, to June 29, 1906, on which latter date the instrument was found to be badly out of balance, due to the front of one of the strips having separated from its back, as in the case of No. 28. The instrument was quite unserviceable.
No. 41...	.0719	.1496	.98	.00045	7.04	Received in June, 1903. Used by Professor Bigelow on the Solar Eclipse Expedition to Africa in August, 1905, and in Washington from June 29, 1906, to November 1, 1906, when it was found that the instrument was badly out of balance, due to the same defect that had developed in Nos. 28 and 34.
No. 90........	.0220	.200	.98	.000	16.12	Received November 1, 1906. While remounting the strips on November 8 the connections between the thermal elements and the binding posts were accidentally broken, throwing the instrument slightly out of balance. It was in use at Washington from November 1, 1906, to July 31, 1907, and at Mount Weather, Va., from September 4, 1907, to February 1, 1908. It is still in serviceable condition, altho slightly out of balance.
No. 28_{bis}......	.02526	.2003	.98	.000	18.48	Received in July, 1907. Has been in continuous use at Washington, and is still in serviceable condition.
No. 104.......	.0217	.2089	.98	.000	15.62	Received December 14, 1907, and is preserved as the standard instrument.
No. 105.......	.02194	.2028	.98	.000	15.85	Received December 14, 1907. In use at Mount Weather since February 1, 1908.

* Coefficient of variation of r with temperature. † For temperature of strips = 20° C.

[8] Sul pireliometer a compensazione elettrica del Ångström. Atti della Reale Accademia dei Lincei, Vol. XIV, p. 340 and 451.

In Table 2 is given a brief history of the Ångström pyrheliometers that have been used by the Weather Bureau.

These pyrheliometers may be divided into two classes, as follows:

1. Nos. 28, 31, 34, and 41, the strips exposed to radiation being of platinum, and k in consequence varying with the temperature. As has already been indicated, it is quite probable that the difference between the temperature as shown by the attached thermometers and the true temperature of the strips may introduce an error of −1 per cent in the indications of these instruments.

2. Nos. 90, 28_{bis}, 104, and 105, the strips exposed to radiation being of manganin, the temperature coefficient of which is zero. The error above referred to is therefore eliminated in these instruments.

In a letter transmitting the certificates to pyrheliometers Nos. 104 and 105, Ångström stated that both were exceptionally fine instruments, in that the two sides were almost perfectly symmetrical. He had therefore determined their constants with great care, and he exprest the hope that No. 104 might be preserved as a radiation standard. The comparisons in Table 4, which include readings on both Nos. 104 and 105, as well as comparisons with Smithsonian instruments, are therefore of special interest.

On October 25 and 29, 1901, April 9, 17, and 21, 1903, April 15, 1905, and during comparisons with Smithsonian instruments on July 27, 1907, and February 8, 1908, simultaneous readings were made by two observers upon the instruments compared. In other cases all the readings were made by the writer, with the exception of those on Nos. 90 and 105 on February 6 and 8, 1908, which were made by Mr. W. R. Gregg at Mount Weather. Comparative readings by one observer were, when possible, made in the order indicated in Table 3, where the two instruments undergoing comparison are designated by A and B, respectively, the object being to eliminate the effect of the change in air mass as far as possible.

TABLE 3.—*Order of reading pyrheliometers undergoing comparison.*

					Computed means.	
First set of readings	A_1	B_1	B_2	A_2	$\frac{A_1+A_2}{2}$	$\frac{B_1+B_2}{2}$
Second set of readings	B_1	A_1	A_2	B_2	$\frac{A_1+A_2}{2}$	$\frac{B_1+B_2}{2}$

Sometimes, however, and this was generally the case in the comparisons made between June 27 and November 25, 1905, inclusive,

TABLE 4.—*Comparison of pyrheliometers.*

Date.	No. of readings.	No. 31 / No. 34	No. 28 / No. 34	No. 41 / No. 34	S. I. No. 1_a / No. 28	S. I. No. 1_b / No. 34	S. I. No. V / No. 28_{bis}	No. 90 / No. 28_{bis}
October 25, 1901	11	1.005						
October 29, 1901	20		0.917					
April 9, 1903	4		0.986					
April 17, 1903	6				1.355			
April 21, 1903	5				1.370			
June 16, 1903	2			1.003				
June 18, 1903	4			1.010				
April 15, 1905	4			0.977				
April 25, 1905	6			0.960				
April 28, 1905	2			0.958				
June 27, 1905	4					1.15		
July 17, 1905	6					1.11		
July 25, 1905	6					1.13		
July 26, 1905	3					1.11		
August 4, 1905	4					1.14		
August 22, 1905	4					1.11		
September 19, 1905	5					1.15		
September 21, 1905	6					1.15		
September 22, 1905	5					1.15		
September 26, 1905	7					1.15		
September 28, 1905	4					1.17		
October 4, 1905	5					1.14		
October 5, 1905	7					1.15		
November 1, 1905	6					1.14		
November 2, 1905	3					1.14		
November 14, 1905	5					1.15		
November 17, 1905	2					1.13		
November 21, 1905	4					1.12		
November 23, 1905	4					1.13		
November 25, 1905	3					1.12		
December 22, 1905	4			0.958				
December 26, 1905	10			0.947				
January 9, 1906	12			0.988				
January 10, 1906	10			0.985				
January 29, 1906	4	0.924						
Do	2			0.958				
January 30, 1906	2			0.968				
February 6, 1906	2			0.904				
February 14, 1906	2			0.931				
July 27, 1907	16						1.107	
Do	14							0.962

Date.	No. of readings.	No. 31 / No. 28_{bis}	No. 104 / No. 28_{bis}	No. 105 / No. 28_{bis}	No. 105 / No. 31	No. 105 / No. 104	No. 105 / No. 90	S. I. No. V / No. 104
December 5, 1907	14	0.955						
December 6, 1907	12	0.961						
December 31, 1907	4		1.057					
Do	4					1.014		
January 2, 1908	2			1.028				
January 3, 1908	5			1.097				
Do	2				1.060			
January 6, 1908	4				1.076			
January 9, 1908	4				1.075			
Do	8			1.065				
January 14, 1908	12			1.070				
January 15, 1908	2			1.072				
January 17, 1908	6			1.067				
Do	4				1.096			
January 30, 1908	2				1.100			
Do	10					1.008		
Do	4			1.066				
February 6, 1908	8						1.061	
February 7, 1908	2		1.061					
February 8, 1908	6		1.065					
Do	9							1.111
Do	8						1.064	

S. I. No. 1_a = Smithsonian Institution actinometer No. 1 (Old). Reduction factor employed = 0.7524.
S. I. No. 1_b = Smithsonian Institution actinometer No. 1 (New). Reduction factor employed = 0.8102.
S. I. No. V = Smithsonian Institution actinometer No. V. Reduction factor employed = 0.8479.

only occasional observations could be made with one of the instruments, while the other was read almost continuously. In such cases the readings of one or both the instruments were plotted as shown in fig. 1, and interpolations were made to reduce the readings of both instruments to a common air mass.

In fig. 1 the difference between the logarithms of the radiation measurements by the two instruments averages about 0.058, which is equivalent to a percentage difference of 14. The cross-section paper had ten times the number of lines shown in the figure.

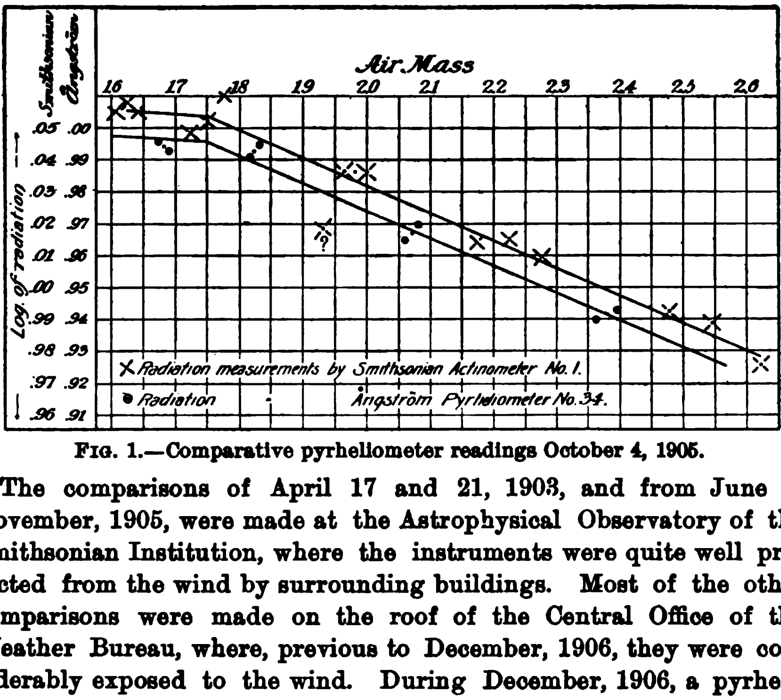


FIG. 1.—Comparative pyrheliometer readings October 4, 1905.

The comparisons of April 17 and 21, 1903, and from June to November, 1905, were made at the Astrophysical Observatory of the Smithsonian Institution, where the instruments were quite well protected from the wind by surrounding buildings. Most of the other comparisons were made on the roof of the Central Office of the Weather Bureau, where, previous to December, 1906, they were considerably exposed to the wind. During December, 1906, a pyrheliometer shelter was constructed, the south side of the roof of which was provided with sliding shutters, that could be opened sufficiently to admit solar radiation to the instrument without admitting the wind.

All mil-ammeters were carefully standardized by the U. S. Bureau of Standards, and the corrections to scale readings thus determined have been applied; but since December, 1905, the installation of the instruments has been such that by means of suitable switches one mil-ammeter and one galvanometer were made to answer for the two pyrheliometers being compared.

Directing our attention to the comparisons between different Ångström instruments, it will be seen from Table 4 that while Nos. 31, 34, and 41 were in very close agreement when received, Nos. 31 and 41 read considerably lower than No. 34 in 1905 and 1906, while No. 28 read lower from the very first. Also, that while No. 90 read about 2 per cent lower than No. 28_{bis} in July, 1907, comparisons with No. 105 indicate that it read about 1 per cent higher than No. 28_{bis} in January and February, 1908; and while Nos. 104 and 105 agreed with each other within about 1 per cent when received in December, 1907, Nos. 28_{bis} and 90 read 6 per cent and 5 per cent, respectively, lower than No. 104. From these comparisons alone it therefore appears that a progressive deterioration took place in Nos. 31, 41, 90, and 28_{bis}, after their receipt.

TABLE 5.—*Comparisons of Ångström pyrheliometers with Smithsonian actinometers.*

Date.	July 27, 1907.	February 8, 1908.
Instruments.	$\frac{\text{S. I. No. V.}}{\text{No. } 28_{bis}}$	$\frac{\text{S. I. No. V.}}{\text{No. 104}}$
	1.102	1.111
	1.111	1.116
	1.107	1.115
	1.098	1.100
	1.114	1.117
	1.114	1.121
	1.119	1.115
	1.105	1.112
	1.114	1.069
	1.121	....
	1.106	....
	1.086	....
	1.105	....
	1.109	....
	1.114	....
	1.092	....
Means	1.107	1.111

Four sets of comparisons with Smithsonian Institution actinometers have been made, as follows:

(1) April 17 and 21, 1903, with Ångström pyrheliometer No. 28, a critical examination of which only a few days later showed it to be in an unserviceable condition thru the separation of the strips. The differences between consecutive readings of the Ångström instrument were large and irregular. But little weight can, therefore, be given to this series.

(2) Between June 27 and November 25, 1905, comparative readings were made with Ångström pyrheliometer No. 34 on practically every clear day, the Smithsonian actinometer reading from 11 to 17 per cent higher than the Ångström, the mean being 14 per cent.

(3) On July 27, 1907, sixteen simultaneous readings were made with No. 28_{bis}.

(4) On February 8, 1908, nine simultaneous readings were made with No. 104.

The detailed results of (3) and (4) are shown in Table 5. These comparisons were made on unusually clear days.

Some of the irregularities in Table 4 are attributable to the fact that observations were sometimes made when the atmospheric conditions were unfavorable on account of the presence of smoke or haze in varying quantities.

From the fact that Nos. 34 and 41 were in accord when No. 41 was received in June, 1903, it seems probable that No. 34 underwent little change until one of its strips separated in June, 1906. Assuming this to be the case, we may summarize Table 4, and at the same time rearrange it, so as to make the readings on all instruments comparable with Smithsonian Institution actinometers, as shown in Table 6, summary of comparison of pyrheliometers. It is believed that the reduction factors given in the foot note following Table 4 have reduced the readings of Smithsonian actinometers No. 1_a, No. 1_b, and No. V to a common scale.

We must conclude from the results of the comparisons of July 27, 1907, and February 8, 1908, as shown in Table 5, that the Smithsonian instruments had undergone no change between those dates; also, from Table 6, that Nos. 28_{bis}, 104, and 105 were in close agreement when received; and that Nos. 28_{bis} and 90, like Nos. 31 and 34, and also like Nos. 19 and 39 which were compared by Chistoni, had deteriorated with age.

A difference of 11 per cent between the readings of Ångström and Smithsonian instruments, when the former are in good condition, appears to be established, the Ångström instrument reading the lower. The fact that there was a difference of 14 per cent between No. 34 and the Smithsonian actinometer may have been partly due to the error common to all pyrheliometers with platinum strips, already referred to, and partly to a very slight deterioration in No. 34 with age.

For a description of the Smithsonian actinometer see Annual Report of the Smithsonian Institution, 1903, p. 80–81. See also the annual reports for 1904 and 1905 for a discussion of the standard pyrheliometer designed by Mr. Abbot. From the statement on p. 77 of the Annual Report for 1906 it appears that the Smithsonian actinometers that are here compared with the Ångström pyrheliometers are in close agreement with this Smithsonian standard pyrheliometer. The method

TABLE 6.—*Summary of comparison of pyrheliometers.*

Date.	Number of readings.	S. I. No. 34	S. I. No. 31	S. I. No. 28	S. I. No. 41	S. I. No. 90	S. I. No. 28_{bis}	S. I. No. 104	S. I. No. 105	Remarks.
October 25, 1901	11	1.14	......	......	......	......	......	......	......	Ratio assumed to be the same as in 1905.
October 25, 1901	11	......	1.134	......	......	......	......	......	......	Thru comparison with No. 34.
October 29, 1901	20	......	......	1.24	......	......	......	......	......	Thru comparison with No. 34.
April 9, 1903	4	......	......	1.22	......	......	......	......	......	Thru comparison with No. 34.
April 17, 1903	6	......	......	1.355	......	......	......	......	......	Direct comparison with Smithsonian actinometer.
April 21, 1903	5	......	......	1.37	......	......	......	......	......	Direct comparison with Smithsonian actinometer.
June 16, 1903	2	......	......	......	1.187	......	......	......	......	Thru comparison with No. 34.
June 18, 1903	4	......	......	......	1.129	......	......	......	......	Thru comparison with No. 34.
April 15–28, 1905	12	......	......	......	1.18	......	......	......	......	Thru comparison with No. 34.
June–November, 1905	93	1.14	......	......	......	......	......	......	......	Direct comparison with Smithsonian actinometer.
December, 1905–February, 1906	40	......	......	......	1.18	......	......	......	......	Thru comparison with No. 34.
January 29, 1906	4	......	1.234	......	......	......	......	......	......	Thru comparison with No. 34.
July 27, 1907	16	......	......	......	......	......	1.107	......	......	Direct comparison with Smithsonian actinometer.
July 27, 1907	14	......	......	......	......	1.127	......	......	......	Thru comparison with No. 28_{bis}.
December 5–6, 1907	26	......	1.23	......	......	......	......	......	......	Thru comparison with No. 28_{bis}.
January 3–30, 1908	16	......	1.19	......	......	......	......	......	......	Thru comparison with No. 105.
December 31, 1907–February 7, 1908	12	......	......	......	......	......	1.179	......	......	Thru comparison with No. 104.
January 2–30, 1908	39	......	......	......	......	......	1.177	......	......	Thru comparison with No. 105.
February 6–8, 1908	16	......	......	......	......	1.169	......	......	......	Thru comparison with No. 105.
December 31, 1907–January 30, 1908	14	......	......	......	......	......	......	......	1.100	Thru comparison with No. 104.
February 8, 1908	9	......	......	......	......	......	......	1.111	......	Direct comparison with Smithsonian actinometer.

employed by Mr. Abbot in standardizing this latter instrument was such as to leave little doubt as to the accuracy of his determinations.

The reason for the difference in the determinations by the Ångström and the Smithsonian pyrheliometers, and also the cause of the deterioration of the Ångström pyrheliometers with age are subjects for investigation. Certainly we would not be justified in maintaining that the indications of the Ångström pyrheliometer, exprest in absolute units, are to be accepted as correct within 2 per cent, unless we have shown thru comparison with some other standard that the Ångström instrument has undergone no change since it left the hands of the maker.

Previous to December, 1906, it was customary to pack the pyrheliometers in their wooden cases at the end of each day's work, and these cases were kept indoors. Since December, 1906, the pyrheliometers have been permanently installed in a pyrheliometer shelter, which is without heating facilities, but which affords protection from the rain.

The pyrheliometer observations that have been made at Washington and at Mount Weather will be discust in a paper which is to follow.

NOTE ON THE MOVEMENT OF MOISTURE IN SOILS

By W. J. Humphreys.

It is known that evaporation, condensation, and surface tension all play important rôles in the movement of moisture in soils. The U. S. Department of Agriculture has conducted a number of investigations on these subjects and has reached some valuable conclusions. The effects, however, due to changes in surface tension, produced by changes in temperature have not been considered in detail, nor do I recall having seen them anywhere else.

It has long been known that the surface tension of a liquid increases as its temperature is lowered. In the case of water, at least, this relation continues at the same rate to and below the ordinary freezing point, provided the liquid condition is maintained; and therefore any change in the temperature of the soil, such as takes place to a greater or less extent every day and night, must produce a corresponding movement of its moisture toward the colder parts, where the surface tension is greatest. Besides, evaporation, which is most rapid where the temperature is highest, and condensation, which is greatest on the coldest surfaces, produce moisture movements in the same direction as those made by temperature changes in surface tension, so that the several causes work together. But, owing to a variety of influencing conditions, their relative importance in producing the common effect is not easy to determine.

Evidently, since the temperature is nearly always lower at night than during the daytime, the upper layer of the soil thus cooled is usually damper in the early morning than in the afternoon; and whenever the temperature falls very greatly the corresponding large increase in the tension and in the condensation at the cold surface will take much moisture from the soil beneath. It is largely, if not wholly, this that leads to wet soils so often seen on cold mornings when there has been no rain and to the surprising depth of mud that frequently follows a thaw. It accounts too for the considerable supply of moisture from the deeper soil in the production of ice columns or spewing of the ground.

This temperature effect on evaporation, on condensation, and on surface tension also greatly conserves whatever moisture is already in

the earth and keeps it in motion. That is, the moisture is brought to the surface in greatest abundance only when the temperature there is low and therefore the rate of evaporation into the air small; and whenever the surface temperature is increased, leading to a higher rate of evaporation into the air, the moisture is drawn away to the colder portions of the soil beneath, where it is protected from the winds by the top layers which it has just left.

NOTE ON THE MAGNETIC FIELD DUE TO AN ELECTRIC CURRENT IN A STRAIGHT WIRE.

By W. J. Humphreys.

The force in dynes on a unit magnetic pole at any point outside an infinitely long straight wire carrying a current is numerically equal to $2C/a$, where C is the current in absolute units and a the distance in centimeters of the point from the center of the wire, and its direction is tangent to a circle thru whose center the wire passes at right angles.

While the approximate direction of the force is easily found experimentally, its numerical value is determined only by integrating the

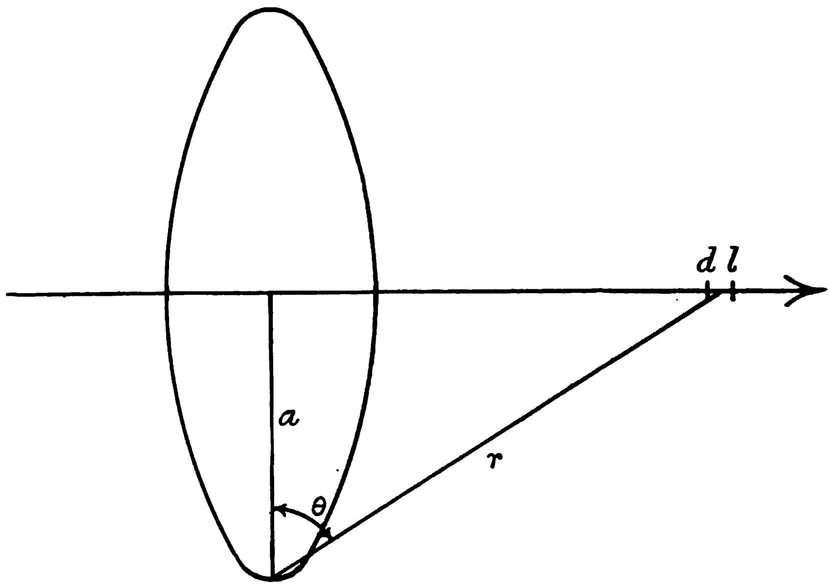


Fig. 1.

effects of all parts of the current. But since the force at any point lies in a plane at right angles to the wire it is not immediately obvious just why, in determining its value, it is necessary to consider the current in parts of the wire off this plane.

This is one of the many places where the electron theory can be used to marked advantage. But whether more or less convenient it should be used, since it appears to be the most nearly correct theory so far advanced, or the one that explains the largest number of known facts.

Let electrons, all moving in the same direction with the constant velocity V centimeters per second, be uniformly distributed along a straight wire, and let E be the total amount of electricity per centimeter length of the wire. Assume the field of force from each electron to be the same in all directions, as it is about an isolated charge at rest with reference to the ether. Then the rate of change of induction, due to electricity at all points of the wire, thru a circle at right angles to it of radius a—the rate at which the circumference of this circle cuts the lines of static force—or in other words, the work required to carry a unit magnetic pole once around this circle (see fig. 1) is given by the equation

$$\frac{dF}{dt}=2\int_0^{\infty}\frac{Edl}{r^2}2\pi aV\cos\theta\,.$$

But $\cos\theta dl=rd\theta$, $l/r=\cos\theta/a$, and $EV=C$, the current. Hence

$$\frac{dF}{dt}=4\pi C\int_0^{\pi/2}\cos\theta\,d\theta=4\pi C,$$

and therefore the force on a unit pole at any point on the circumference of this circle is

$$\frac{4\pi C}{2\pi a}=\frac{2C}{a}\,.$$

However, presumably the field due to each electron is influenced by every one of the others, and so influenced by them that it is confined to a plane at right angles to the wire, and equal in every direction from it. From this it follows at once that the number of lines of force cutting, per second, across the boundary of any plane figure at right angles to the wire is 4π times the quantity of electricity passing thru the plane of the figure in the same time, or that

$$\frac{dF}{dt}=4\pi EV=4\pi C,$$

and

$$f=\frac{4\pi C}{2\pi a}=\frac{2C}{a}\,.$$

According to this conception, which I believe to be the correct one, the magnetic force at any point outside a straight wire carrying a current is due entirely to that part of the current nearest the point; the more distant parts have no direct effect whatever. But, as just explained, all electrons produce their full effects indirectly by compressing each other's fields into planes at right angles to the wire.

The above is given not as anything distinctly new in physics, but as a simple and useful application of the electron theory of currents.

A KITE FOR USE IN HIGH WINDS.

By W. R. Blair.

The problem of obtaining daily upper-air observations by means of kites is a comparatively simple one so long as the winds are over 10 miles per hour (4.5 meters per second) and under 25 (11.2 meters per second), but kites adapted to this range of velocities are not efficient outside of it and vice versa. During the winter months at Mount Weather, Va., it is very frequently necessary to make flights in winds much higher than these, and a kite strong enough to stand the strain put upon it and stable enough to enable the instrument it carries to make an interpretable record becomes essential to the securing of continuous daily readings.

Kite No. 17 has served very well in high winds, a successful flight of 7,600 feet having been obtained recently in a wind of 46 miles per hour (20.6 meters per second). Its dimensions are as follows:

Height	7 feet 8 inches	233.7 centimeters.
Width	4 feet 6 inches	137.2 centimeters.
Depth	2 feet 8 inches	81.3 centimeters.
Weight	8 pounds	73.6 kilograms.
Width of planes	2 feet 7¼ inches	79.4 centimeters.
Plane space	2 feet 8 inches	81.3 centimeters.
Total lifting surface	58 square feet	5.4 square meters.

As will be seen from these dimensions, the ratio of the steering surface to the lifting has been increased from ⅓ (see this Bulletin, Vol. I, Part 1, p. 13) to ½. The proportions of the kite have been varied to suit the change in this ratio and with a view to strengthening the framework without increasing the weight of the sticks used. These sticks are made of straight-grained spruce and are ¼ by ⅝ inch cross-section except the stick to which the bridle is fastened, which is ⅝ by ⅝ inch.

The behavior of this kite during flight is remarkably steady, and while the angle of elevation taken by it is not so high as that taken by the kites described in the last number of the Bulletin, assisted by smaller kites of similar proportions flights of from 6,000 to 8,000 feet (2,000 meters) are easily made with it in winds of from 25 to 45 miles per hour (11.2 to 20.1 meters per second).

UPPER AIR TEMPERATURES FOR OCTOBER, NOVEMBER, AND DECEMBER.

By the Aerial Section—W. R. BLAIR, in charge.

For the method of tabulating data and constructing charts of upper air isotherms and gradients see Vol. I, Part 1, of this Bulletin, with the following exceptions: In the isothermal charts the actual altitudes reached are indicated by a red **T** instead of by a solid line all the way down to the ground level, the latter sometimes interfering with the isothermal lines. The braces and maximum temperatures, indicating inversion layers, are in red.

Fig. 1 is inserted because the isothermal chart for October does not give the upper 1,600 meters (1 mile) of the gradient for the third day. This flight was begun at 7 a. m. and the ascent shows an inversion of temperature which is characteristic of this time of day. At an altitude of from 3,000 to 5,000 meters the temperatures observed in the descent indicate the advance of a cooler body of air the minimum surface temperature of which reached Mount Weather about fifty hours later.

The mean of the highest altitudes reached daily in October was 8,094 feet (2,467 meters) and for the three months, October, November, and December, 7,684 feet (2,342 meters), while the highest altitude reached was 23,110 feet (7,044 meters). This is the record flight for this observatory and to date the greatest height attained by means of kites.

The numerical results of kite flights and the isothermal charts for October, November, and December follow:

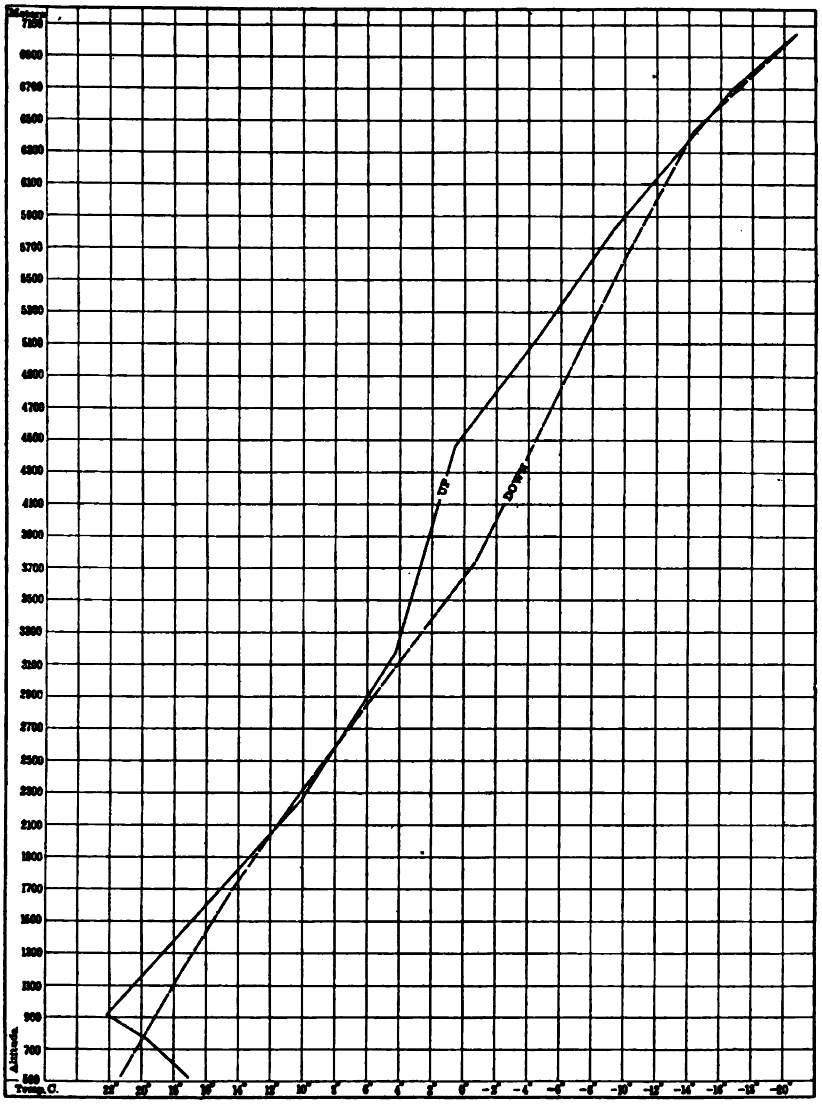


FIG. 1.—Temperature gradient, flight of October 3, 1907.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Oct. 1, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:18 a. m.	41.4	5.2	80	nw.	23	10.3	1,725	526	41.4	5.2	80	nw.	23	10.3
7:29 a. m.	42.0	5.6	80	nw.	23	10.3	2,866	874	40.0	4.5	....	n.	......	......
7:40 a. m.	43.0	6.1	80	nw.	24	10.7	3,688	1,124	48.2	9.0	....	n.	......	......
8:23 a. m.	45.0	7.2	79	nw.	28	12.5	5,399	1,646	57.2	14.0	....	nnw.	......	......
8:25 a. m.	45.0	7.2	79	nw.	28	12.5	5,734	1,748	56.3	13.5	....	nnw.	......	......
8:50 a. m.	45.7	7.6	76	nw.	21	9.4	6,911	2,107	52.6	11.5	....	n.	......	......
9:44 a. m.	48.0	8.9	63	nw.	19	8.5	9,412	2,869	42.7	6.0	....	nnw.	......	......
10:53 a. m.	51.2	10.7	60	nw.	16	7.2	8,870	2,704	45.1	7.3	....	n.	......	......
11:11 a. m.	51.7	10.9	61	nw.	16	7.2	6,028	1,838	52.2	11.2	....	n.	......	......
11:20 a. m.	52.0	11.1	....	nw.	16	7.2	3,366	1,026	53.9	12.2	....	n.	......	......
11:22 a. m.	52.1	11.2	....	nw.	16	7.2	2,831	863	47.8	8.8	....	n.	......	......
11:29 a. m.	52.5	11.4	58	nw.	16	7.2	1,725	526	52.5	11.4	58	nw.	16	7.2
Oct. 2, 1907.														
3:30 p. m.	63.0	17.2	62	se.	16	7.2	1,725	526	63.0	17.2	62	se.	16	7.2
3:43 p. m.	62.8	17.1	62	se.	15	6.7	2,811	857	57.6	14.2	....	s.	......	......
6:05 p. m.	60.0	15.6	68	s.	14	6.3	3,306	1,007	57.9	14.4	....	wsw.	......	......
6:44 p. m.	60.0	15.6	68	s.	10	4.5	3,865	1,178	57.2	14.0	....	......	......	......
6:57 p. m.	60.0	15.6	68	s.	10	4.5	8,204	2,500	44.1	6.7	....	wnw.	......	......
7:10 p. m.	60.0	15.6	69	s.	10	4.5	6,538	1,993	49.3	9.6	....	wnw.	......	......
7:30 p. m.	59.7	15.4	72	s.	12	5.4	4,806	1,465	55.4	13.0	....	w.	......	......
7:47 p. m.	60.2	15.7	69	s.	11	4.9	1,725	526	60.2	15.7	69	s.	11	4.9

October 1, 1907.—Three kites having a total lifting surface of 221 sq. ft. (18.9 sq. m.) were used. Wire out, 17,000 ft. (5,182 m.); at maximum altitude, 14,000 ft. (4,267 m.).

During the earlier part of the flight about one-third of the sky was covered with Ci. clouds moving from the north-northwest.

An area of high pressure was central over the Great Lakes, low pressure over Nova Scotia.

October 2, 1907.—Four kites having a total lifting surface of 277.5 sq. ft. (25.7 sq. m.) were used. Wire out, 8,500 ft. (2,591 m.); at maximum altitude, 7,500 ft. (2,286 m.).

The sky was cloudless thruout the flight.

High barometric pressure prevailed along the Atlantic coast and an area of low pressure was central over Minnesota.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Oct. 3, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:00 a. m...	62.7	17.1	78	w.	17	7.6	1,725	526	62.7	17.1	78	w.	17	7.6
7:21 a. m...	64.2	17.9	75	w.	16	7.2	2,524	769	67.5	19.7	....	wnw.	......	......
8:30 a. m...	68.0	20.0	66	w.	14	6.3	2,980	908	71.8	22.1	....	nw.	......	......
10:16 a. m...	71.0	21.7	62	w.	13	5.8	4,906	1,495	62.4	16.9	....	w.	......	......
12:30 p. m...	72.5	22.5	65	w.	10	4.5	7,472	2,277	49.8	9.9	....	wsw.	......	......
1:27 p. m...	73.4	23.0	64	w.	8	3.6	10,376	3,163	39.7	4.3	....	w.	......	......
2:53 p. m...	74.5	23.6	62	s.	9	4.0	14,606	4,452	33.1	0.6	....	nw.	......	......
3:44 p. m...	73.5	23.1	62	s.	7	3.1	16,738	5,102	24.1	− 4.4	....	wnw.	......	......
4:40 p. m...	72.7	22.6	62	s.	8	3.6	19,198	5,852	14.7	− 9.6	....	wnw.	......	......
5:33 p. m...	71.4	21.9	63	sw.	9	4.0	21,978	6,698	1.8	−16.8	....	wnw.	......	......
6:05 p. m...	70.0	21.1	65	s.	10	4.5	23,110	7,044	−5.4	−20.8	...	wnw.	......	......
7:57 p. m...	70.4	21.3	62	sw.	11	4.9	21,116	6,436	6.1	−14.4	....	wnw.	......	......
8:40 p. m...	70.9	21.6	61	sw.	12	5.4	18,710	5,703	13.3	−10.4	....	wnw.	......	......
9:18 p. m...	71.0	21.7	60	sw.	13	5.8	12,667	3,789	30.6	− 0.8	....	w.	......	......
10:12 p. m...	70.0	21.1	59	sw.	13	5.8	7,491	2,283	50.5	10.3	....	wsw.	......	......
10:34 p. m...	70.0	21.1	58	sw.	12	5.4	5,733	1,748	57.2	14.0	....	wsw.	......	......
10:50 p. m...	70.5	21.4	58	sw.	13	5.8	3,836	1,169	63.7	17.6	....	wsw.	......	......
11:04 p. m...	70.3	21.3	55	sw.	14	6.3	1,725	526	70.3	21.3	55	sw.	14	6.3
Oct. 4, 1907.														
9:56 a. m...	65.0	18.3	90	w.	24	10.7	1,725	526	65.0	18.3	90	w.	24	10.7
10:08 a. m...	65.0	18.3	90	w.	15	6.7	3,011	918	61.9	16.6	....	wnw.	......	......
10:18 a. m...	64.5	18.1	92	w.	15	6.7	4,197	1,279	55.8	13.2	....	nw.	......	......
10:27 a. m...	65.0	18.3	94	w.	15	6.7	5,426	1,654	52.3	11.3	....	wnw.	......	......
10:40 a. m...	66.1	18.9	90	w.	16	7.2	6,116	1,864	50.0	10.0	...	nw.	......	......
11:08 a. m...	66.5	19.2	82	nw.	15	6.7	7,256	2,212	48.2	9.0	....	nw.	......	......
11:17 a. m...	67.0	19.4	82	w.	21	9.4	8,563	2,610	46.1	7.8	....	nw.	......	......
11:49 a. m...	67.7	19.8	81	w.	21	9.4	6,051	1,844	58.6	14.8	....	nw.	......	......
12:00 noon .	68.1	20.1	81	w.	21	9.4	4,896	1,492	56.1	13.4	....	nw.	......	......
11:09 p. m...	68.8	20.4	81	......	......	......	2,417	737	64.6	18.1	...	......	......	......
12:16 p. m...	68.8	20.4	81	w.	19	8.5	1,725	526	68.8	20.4	81	w.	19	8.5

October 3, 1907.—Eight kites having a total lifting surface of 506 sq. ft. (47 sq. m.) were used. Wire out, 38,500 ft. (11,735 m.); at the maximum altitude, 37,300 ft. (11,369 m.).

During the forenoon the sky was partly covered with Ci. and Ci.-St. clouds moving from the west, A.-Cu. at first from the northwest, later from the west-northwest, and some Cu. from the west. St.-Cu. clouds from the west-northwest practically covered the sky at 12:30 p. m. Later A.-Cu. and a few Cu. from the northwest covered two-thirds of the sky, but after 2:30 p. m. they gave place to A.-St. from the west-northwest and St.-Cu. from the west. Cloudiness diminished after 4 p. m., leaving the sky cloudless by 8:40 p. m.

High pressure, central over the Carolinas, covered the Atlantic coast, while a trough of low pressure extended from New Mexico to the upper Lakes, the greatest depression of the barometer being central over Iowa.

October 4, 1907.—Two kites having a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 14,000 ft. (4,267 m.); at the maximum altitude.

St.-Cu. clouds from the northwest and a few A.-St. apparently without direction covered practically the whole sky until 11 a. m. and two-thirds of the sky thereafter. Light rain fell from 10:05 until 10:18 a. m. The leading kite was obscured by clouds from about 11:13 to about 11:23 a. m.

Low pressure was central over the lower St. Lawrence Valley, while high pressure prevailed over Georgia and over portions of Wyoming and Idaho.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Oct. 5, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:10 a. m...	52.5	11.4	75	nw.	19	8.5	1,725	526	52.5	11.4	75	nw.	19	8.5
7:37 a. m...	52.6	11.4	75	nw.	17	7.6	3,011	918	48.9	9.4	....	nw.	......	......
7:47 a. m...	53.4	11.9	73	nw.	19	8.5	4,121	1,256	43.9	6.6	....	wnw.	......	......
8:02 a. m...	53.2	11.8	81	nw.	14	6.3	5,192	1,582	38.3	3.5	....	wnw.	......	......
8:25 a. m..	54.5	12.5	77	nw.	18	8.0	6,225	1,897	36.4	2.4	....	wnw.	......	......
8:48 a. m...	53.5	13.1	64	nw.	22	9.8	7,466	2,276	34.9	1.6	...	wnw.	......	......
10:00 a. m...	56.4	13.6	45	nw.	34	15.2	8,829	2,691	32.9	0.5	....	nw.	......	......
10:52 a. m...	57.5	14.2	47	nw.	24	10.7	4,283	1,305	42.1	5.6	....	nw.	......	......
11:20 a. m...	57.0	13.9	49	nw.	24	10.7	1,725	526	57.0	13.9	49	nw.	24	10.7
Oct. 7, 1907.														
7:22 a. m...	59.6	15.3	62	sw.	12	5.4	1,725	526	59.6	15.3	62	sw.	12	5.4
7:42 a. m...	59.7	15.4	64	sw.	13	5.8	2,767	843	60.1	15.6	....	sw.	......	......
8:20 a. m...	62.5	16.9	60	sw.	11	4.9	5,232	1,595	54.5	12.5	....	w.	......	......
8:36 a. m...	63.5	17.5	59	sw.	12	5.4	5,748	1,752	50.7	10.4	...	w.	......	......
10:32 a. m...	64.0	17.8	68	s.	12	5.4	8,634	2,632	46.4	8.0	....	wsw.	......	......
11:11 a. m...	64.5	18.1	65	s.	15	6.7	11,835	3,607	37.0	2.8	....	wsw.	......	......
12:03 p. m...	65.5	18.6	68	s.	19	8.9	7,950	2,949	42.8	6.0	....	wsw.	......	......
12:20 p. m...	66.6	19.2	68	s.	16	7.2	7,468	2,276	49.3	9.6	....	wsw.	......	......
12:41 p. m...	67.7	19.8	61	s.	12	5.4	4,084	1,245	54.3	12.4	....	sw.	......	......
12:51 p. m...	67.7	19.8	61	s.	14	6.3	1,725	526	67.7	19.8	61	s.	14	6.3
Oct. 8, 1907.														
1:37 p. m...	50.5	10.3	54	nw.	30	13.4	1,725	526	50.5	10.3	54	nw.	30	13.4
1:42 p. m...	51.2	10.8	53	nw.	33	14.8	2,997	913	43.8	6.8	....	nw.	......	......
1:47 p. m...	50.8	10.4	52	nw.	31	13.9	3,747	1,142	37.9	3.3	....	nnw.	......	......
2:01 p. m...	52.0	11.1	52	nw.	24	10.7	5,051	1,540	33.4	0.8	....	nnw.	......	......
2:12 p. m...	52.0	11.1	52	nw.	25	11.2	6,124	1,867	35.8	2.1	....	n.	......	......
2:27 p. m...	52.0	11.1	50	nw.	21	9.4	7,851	2,393	29.8	−1.2	....	n.	......	......
2:38 p. m...	52.3	11.3	50	nw.	21	9.4	8,755	2,669	24.6	−4.1	....	n.	......	......
3:02 p. m...	53.2	11.8	48	nw.	15	6.7	9,161	2,792	24.4	−4.2	....	n.	......	......
3:40 p. m...	53.0	11.1	....	nw.	24	10.7	1,725	526	53.0	11.1	....	nw.	24	10.7

October 5, 1907.—Two kites having a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 15,500 ft. (4,724 m.); at maximum altitude 12,000 ft. (3,658 m.).

A few Cu. clouds from the west-northwest were present at intervals. At an altitude of 7,466 ft. (2,276 m.) above sea level a few small clouds passed under the uppermost kite. Light showers occurred in the afternoon.

An area of low pressure was central over the upper St. Lawrence Valley and a high prevailed over Florida.

October 7, 1907.—Three kites having a total lifting surface of 210 sq. ft. (19.4 sq. m.) were used. Wire out, 20,000 ft. (6,096 m.); at maximum altitude, 18,000 ft. (5,486 m.).

A clear sky prevailed thruout the flight.

High pressure was central off the Carolina coast, and low-pressure areas were central over the upper Lakes and over Oklahoma.

October 8, 1907.—One kite having a lifting surface of 55 sq. ft. (5.1 sq. m.) was used. Wire out, 18,000 ft. (5,486 m.); at maximum altitude, 16,000 ft. (4,877 m.).

Dense fog prevailed in early morning. At beginning of flight about 5/10 Ci. clouds from the west were observed, also a few Cu. from the northwest. At an altitude of 7,851 ft. (2,393 m.) above sea level Cu. clouds passed under the kite. A gale from the northwest during the morning reached a maximum velocity of 66 miles per hour. The wind was more moderate when the kite was launched and gradually diminished during the flight.

A pronounced low was central over the upper St. Lawrence Valley, with steep gradients extending over the station. High pressure was central over Kansas and Oklahoma.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Oct. 9, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:08 p. m...	50.0	10.0	56	se.	12	5.4	1,725	526	50.0	10.0	56	se.	12	5.4
2:15 p. m...	51.2	10.7	57	se.	12	5.4	2,932	894	45.5	7.5	....	s.	......	......
2:44 p. m...	52.0	11.1	46	se.	17	7.6	4,187	1,276	39.4	4.1	....	s.	......	......
3:23 p. m...	52.1	11.2	44	se.	19	8.5	5,019	1,530	43.5	6.4	....	sw.	......	......
4:23 p. m...	51.0	10.6	45	sse.	20	8.9	6,764	2,062	37.4	3.0	....	sw.	......	......
4:44 p. m...	50.8	10.4	47	se.	18	8.0	6,805	2,074	36.1	2.3	....	wsw.	......	......
5:06 p. m...	49.5	9.7	52	se.	18	8.0	7,577	2,310	42.4	5.8	....	sw.	......	......
5:13 p. m...	49.4	9.7	52	se.	18	8.0	6,475	1,974	37.4	3.0	....	sw.	......	......
5:24 p. m...	48.9	9.4	58	se.	18	8.0	5,715	1,742	38.5	3.6	....	sw.	......	......
5:30 p. m...	48.5	9.2	58	se.	18	8.0	4,358	1,328	43.8	6.3	....	sw.	......	......
5:36 p. m...	48.3	9.1	54	se.	17	7.6	3,739	1,140	41.0	5.0	....	s.	......	......
5:49 p. m...	47.9	8.8	54	se.	16	7.2	1,725	526	47.9	8.8	54	se.	16	7.2
Oct. 10, 1907.														
7:43 a. m..	49.0	9.4	61	w.	11	4.8	1,725	526	49.0	0.4	61	w.	11	4.9
8:02 a. m...	50.6	10.3	56	w.	10	4.5	2,686	819	49.3	9.6	....	w.	......	......
8:35 a. m...	52.2	11.2	54	w.	11	4.9	2,928	892	47.3	8.5	....	w.	......	......
9:25 a. m...	54.5	12.5	....	w.	12	5.4	1,725	526	54.5	12.5	....	w.	12	5.4
Oct. 11, 1907.														
9:51 a. m...	54.3	12.4	68	s.	14	6.3	1,725	526	54.3	12.4	68	s.	14	6.3
10:02 a. m...	55.1	12.8	61	se.	15	6.7	3,030	924	52.3	11.3	....	wsw.	......	......
10:23 a. m...	56.8	13.8	59	se.	16	7.2	5,426	1,654	45.0	7.2	....	w.	......	......
10:37 a. m...	57.2	14.0	57	s.	16	7.2	6,393	1,949	40.5	4.7	....	w.	......	......
11:05 a. m...	58.0	14.4	54	s.	7	3.1	8,828	2,691	32.5	0.3	....	w.	......	......
11:10 a. m...	58.0	14.4	54	s.	7	3.1	9,076	2,766	31.1	−0.5	....	w.	......	......
11:13 a. m...	59.0	15.0	54	s.	8	3.6	10,413	3,174	27.0	−2.8	....	wsw.	......	......
11:47 a. m...	59.2	15.1	54	s.	10	4.5	10,887	3,318	25.7	−3.5	....	wsw.	......	......
12:15 p. m...	61.0	16.1	54	s.	10	4.5	8,554	2,607	35.1	1.7	....	w.	......	......
12:25 p. m...	62.2	16.8	54	s.	10	4.5	7,991	2,436	32.4	0.2	....	w.	......	......
12:32 p. m...	62.0	16.7	54	sw.	8	3.6	6,725	2,050	34.5	1.4	....	w.	......	......
12:42 p. m...	62.5	16.0	54	sw.	7	3.1	4,562	1,390	46.9	8.3	....	w.	......	......
12:52 p. m...	62.0	16.7	54	s.	6	2.7	1,725	526	62.0	16.7	54	s.	6	2.7

October 9, 1907.—Four kites having a total lifting surface of 277.5 sq.ft. (25.7 sq. m.) were used. Wire out, 10,000 ft. (3,048 m.); at maximum altitude, 7,900 ft. (2,408 m.).

No clouds.

At 8 a. m. high pressure was central over the station, and an area of low pressure was central over the upper Great Lakes.

October 10, 1907.—Two kites having a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out, 3,000 ft. (914 m.) at the time the kites were highest.

During the flight a few Ci. clouds from the northwest and St.-Cu. clouds from the west were observed. The winds were light and of little depth.

Moderately high pressure was centered over Nova Scotia, while a depression of marked intensity was central over Lake Superior.

October 11, 1907.—Two kites having a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out, 20,000 ft. (6,096 m.) at the time the kites reached their maximum altitude.

During the early part of the flight 1/10 Ci. from the west and 1/10 A.-Cu. clouds from the southwest were observed. Cloudiness increased rapidly just after the flight, and rain began at 1:25 p. m.

Low pressure prevailed over the upper Lakes and a high was central over the northern Rocky Mountain region.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Oct. 12, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:29 a. m...	38.0	3.3	87	nw.	14	6.3	1,725	526	38.0	3.3	87	nw.	14	6.3
7:45 a. m...	38.8	3.8	89	nw.	14	6.3	2,868	873	38.1	3.4	...	nw.	......	......
7:59 a. m...	39.0	3.9	84	nw.	18	8.0	3,837	1,170	34.3	1.3	....	wnw.	......	......
8:10 a. m...	39.2	4.0	82	nw.	20	8.9	4,918	1,498	30.9	− 0.6	....	wnw.	......	......
8:54 a. m...	41.8	5.4	76	nw.	19	8.5	6,386	1,946	25.9	− 3.4	....	wnw.	......	......
9:25 a. m...	44.8	7.1	61	nw.	21	9.4	7,420	2,262	25.2	− 3.8	....	wnw.	......	......
10:04 a. m...	44.7	7.1	60	nw.	23	10.3	6,325	1,928	22.7	− 2.4	....	wnw.	......	......
10:18 a. m...	45.5	7.5	58	nw.	23	10.3	5,210	1,588	28.0	− 2.2	....	nw.	......	......
10:30 a. m...	46.3	7.9	56	nw.	27	12.1	4,482	1,366	30.6	− 0.8	....	wnw.	......	......
10:51 a. m...	46.8	8.2	54	nw.	24	10.7	1,725	526	46.8	8.2	54	nw.	24	10.7
Oct. 14. 1907.														
7:17 a. m...	33.5	0.8	95	nw.	22	9.8	1,725	526	33.5	0.8	95	nw.	22	9.8
7:50 a. m...	35.0	1.7	94	nw.	22	9.8	3,196	974	30.4	− 0.9	....	nw.	......	......
7:58 a. m...	34.5	1.4	90	nw.	24	10.7	3,926	1,197	30.4	− 0.9	....	nnw.	......	......
8:14 a. m...	36.3	2.4	89	nw.	24	10.7	5,480	1,670	28.2	− 2.1	....	nne.	......	......
8:50 a. m...	40.0	4.4	84	nw.	20	8.9	6,460	1,969	23.7	− 4.6	....	nne.	......	......
9:42 a. m...	42.4	5.8	68	nw.	19	8.5	8,652	2,637	16.0	− 8.9	....	nne.	......	......
9:50 a. m...	42.6	5.9	68	nw.	20	8.9	6,334	1,930	24.8	− 4.0	....	nne.	......	......
10:06 a. m...	42.5	5.8	66	nw.	17	7.6	4,612	1,406	28.0	− 2.2	....	n.	......	......
10:09 a. m...	42.5	5.8	66	nw.	16	7.2	4,432	1,351	28.0	− 2.2	....	n.	......	......
10:35 a. m...	43.8	6.6	....	nw.	17	7.6	1,725	526	43.8	6.6	....	nw.	17	7.6
Oct. 15, 1907.														
7:25 a. m...	36.7	2.6	79	w.	14	6.3	1,725	526	36.7	2.6	79	w.	14	6.3
7:45 a. m...	37.6	3.1	80	w.	13	5.8	2,968	905	37.8	3.2	....	nw.	......	......
7:53 a. m...	38.5	3.6	80	w.	11	4.9	3,984	1,214	34.3	1.3	....	nnw.	......	......
8:18 a. m...	40.6	4.8	73	w.	12	5.4	5,218	1,590	30.2	− 1.0	....	nnw.	......	......
8:39 a. m...	41.3	5.2	72	w.	14	6.3	7,499	2,286	36.9	2.7	....	nnw.	......	......
10:40 a. m...	46.3	7.9	61	nw.	23	10.3	8,733	2,662	31.8	− 0.1	....	nw.	......	......
10:50 a. m...	47.5	8.6	61	nw.	23	10.3	7,592	2,314	33.6	0.9	....	nw.	......	......
11:03 a. m...	49.0	9.4	60	nw.	18	8.0	5,441	1,659	42.3	5.7	....	nw.	......	......
11:10 a. m...	48.0	8.9	60	nw.	19	8.5	3,685	1,123	39.6	4.2	....	nw.	......	......
11:35 a. m...	48.5	9.2	57	nw.	19	8.5	1,725	526	48.5	9.2	57	nw.	19	8.5

October 12, 1907.—Three kites having a total lifting surface of 210 sq. ft. (19.1 sq. m.) were used. Wire out, 15,000 ft. (4,572 m.); at maximum altitude, 13,000 ft. (3,962 m.).

The sky was cloudless until 8:40 a. m., when Cu. clouds, moving from the west-northwest, appeared and gradually increased to 7/10 by the end of the flight.

Low pressure was central over the upper St. Lawrence Valley and a high was central over the Dakotas.

October 14, 1907.—Three kites having a total lifting surface of 204 sq. ft. (18.9 sq. m.) were used. Wire out, 15,000 ft. (4,572 m.); at maximum altitude, 13,000 ft. (3,962 m.).

About 2/10 Cu. clouds, moving from the north-northwest, prevailed during the flight at an elevation of 4,400 ft. (1,341 m.).

The station was in the eastern part of an area of high pressure covering the entire eastern half of the country. There were slight barometric depressions over South Dakota and southeast of Florida.

October 15, 1907.—Four kites having a total lifting surface of 277.5 sq. ft. (25.7 sq. m.) were used. Wire out, 15,500 ft. (4,420 m.); at maximum altitude, 10,000 ft. (3,048 m.).

A few Ci.-St. clouds, apparently without direction, were observed during the flight.

High pressure was central over the Atlantic coast States, with its crest just west of the station. Areas of low pressure were central over Iowa and north of Montana.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Oct. 16, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
5:53 p. m...	54.0	12.2	54	s.	8	3.6	1,725	526	54.0	12.2	54	s.	8	3.6
6:10 p. m...	54.2	12.3	57	s.	11	4.9	3,586	1,093	51.8	11.0	....	s.	......	......
6:27 p. m...	55.0	12.8	....	s.	11	4.9	1,725	526	55.0	12.8	....	s.	11	4.9
Oct. 17, 1907.														
3:50 p. m...	62.9	17.2	51	se.	9	4.0	1,725	526	62.9	17.2	51	se.	9	4.0
4:43 p. m...	58.9	14.9	55	se.	10	4.5	2,541	774	56.3	13.5	....	s.	......	......
5:49 p. m...	58.3	14.6	56	s.	10	4.5	3,838	1,170	52.5	11.4	....	wsw.	......	......
6:31 p. m...	58.0	14.4	56	s.	11	4.9	6,770	2,064	43.8	6.8	....	wsw.	......	......
7:30 p. m...	58.0	14.4	57	s.	10	4.5	1,725	526	58.0	14.4	57	s.	10	4.5
Oct. 18, 1907.														
7:32 a. m...	54.5	12.5	58	nw.	32	14.3	1,725	526	54.5	12.5	58	nw.	32	14.3
7:44 a. m...	55.4	13.0	....	nw.	32	14.3	2,848	868	53.6	12.0	....	wnw.	......	......
7:54 a. m...	56.3	13.5	....	nw.	34	15.2	3,726	1,136	52.3	11.3	....	nw.	......	......
8:06 a. m...	56.3	13.5	57	nw.	31	13.9	4,574	1,393	48.6	9.2	....	nw.	......	......
8:42 a. m...	58.2	14.6	54	wnw.	30	13.4	5,826	1,776	43.7	6.5	....	nw.	......	......
9:47 a. m...	60.4	15.8	54	w.	25	11.2	8,302	2,530	39.4	4.1	....	nw.	......	......
10:25 a. m...	61.9	16.6	53	w.	22	9.8	6,545	1,995	42.4	5.8	....	nw.	......	......
10:35 a. m...	61.9	16.6	53	w.	22	9.8	4,170	1,271	49.3	9.6	....	nw.	......	......
11:08 a. m...	63.0	17.2	....	wnw.	21	9.4	1,725	526	63.0	17.2	....	wnw.	21	9.4

RESULTS OF CAPTIVE BALLOON ASCENSION.

Oct. 19, 1907.														
5:29 p. m...	45.0	7.2	52	se.	5	2.2	1,725	526	45.0	7.2	52	se.	5	2.2
5:38 p. m...	44.9	7.2	52	se.	7	3.1	4,673	1,424	38.3	3.5	....	w.	......	......
5:48 p. m...	44.8	7.1	51	se.	6	2.7	3,484	1,062	41.7	5.4	....	sw.	......	......
6:03 p. m. .	44.3	6.8	54	se.	7	3.1	2,371	723	44.8	7.1	....	s.	......	......
6:08 p. m...	44.2	6.8	54	se.	7	3.1	1,725	526	44.2	6.8	54	se.	7	3.1

October 16, 1907.—One kite having a lifting surface of 150 sq. ft. (14.1 sq. m.) was used. Wire out, 3,500 ft. (1,067 m.), at the maximum altitude reached.

An area of high pressure covered the Atlantic coast and was central near the station. Low pressure covered the northwestern border.

October 17, 1907.—Four kites having a total lifting surface of 248 sq. ft. (22.9 sq. m.) were used. Wire out, 8,500 ft. (2,591 m.); at maximum altitude, 5,500 ft. (1,676 m.).

About 4/10 Ci. clouds from the west, present at the beginning of the flight, gave place to 3/10 A.-St. from the southwest by 5:30 p. m.

At 8 a. m. high pressure along the Atlantic coast was central near the station. An area of low pressure was central over the upper Lakes.

October 18, 1907.—Two kites having a total lifting surface of 99 sq. ft. (9.1 sq. m.) were used. Wire out, 14,500 ft. (4,420 m.), at the maximum altitude attained.

A clear sky prevailed.

Low pressure was central over the lower St. Lawrence Valley and a high was central over the Dakotas. A secondary high was central over western Tennessee and northern Alabama.

October 19, 1907.—The flight was made with two captive balloons. Wire out, 6,500 ft. (1,981 m.) at the maximum altitude reached.

The weather was clear.

An area of high pressure extended over the eastern part of the United States, with its central ridge reaching from Chesapeake Bay to eastern Iowa. Shallow depressions lay over southern Texas, Arizona, and northern California.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
Oct. 21, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:40 a. m...	33.0	0.6	83	nw.	26	11.6	1,725	526	33.0	0.6	83	nw.	26	11.6
7:54 a. m...	33.5	0.8	80	nw.	25	11.2	2,822	860	30.4	— 0.9	....	nnw	......	......
8:14 a. m...	33.8	1.0	81	nw.	24	10.7	3,650	1,112	36.5	2.5	....	n.	......	......
8:50 a. m...	35.0	1.7	77	nw.	24	10.7	5,432	1,656	36.9	2.7	....	nnw.	......	......
9:22 a. m...	35.6	2.0	72	nw.	20	8.9	6,238	1,902	33.4	0.8	....	nnw.	......	......
9:49 a. m...	37.5	3.1	66	n.	22	9.8	8,633	2,631	28.4	— 2.0	....	nw.	......	......
9:54 a. m...	38.0	3.3	66	n.	22	9.8	9,871	3,009	30.4	— 0.9	....	nw.	......	......
10:14 a. m...	38.8	3.8	68	nw.	18	8.0	7,967	2,428	33.8	1.0	....	nw.	......	......
10:32 a. m...	38.5	3.6	64	nw.	15	6.7	5,776	1,760	33.8	1.0	....	nnw.	......	......
10:35 a. m...	38.5	3.6	64	nw.	15	6.7	3,973	1,211	30.4	— 0.9	....	nnw.	......	......
10:40 a. m...	39.4	4.1	60	nw.	15	6.7	3,003	984	32.0	0.0	....	nnw.	......	......
11:03 a. m...	40.0	4.4	55	nw.	16	7.2	1,725	526	40.0	4.4	55	nw.	16	7.2
Oct. 22, 1907.														
7:41 a. m...	42.0	5.6	54	ssw.	12	5.4	1,725	526	42.0	5.6	54	ssw.	12	5.4
7:57 a. m...	42.4	5.8	52	s.	12	5.4	2,662	812	45.9	7.7	....	sw.	......	......
8:44 a. m...	43.0	6.1	56	se.	11	4.9	3,393	1,034	49.8	9.9	....	ssw.	......	......
9:46 a. m...	44.4	6.9	60	se.	11	4.9	4,775	1,455	49.1	9.5	....	wsw.	......	......
9:55 a. m...	44.7	7.1	58	se.	11	4.9	6,664	2,031	44.8	7.1	....	w.	......	......
10:15 a. m...	45.2	7.3	58	s.	11	4.9	8,498	2,589	40.6	4.8	....	w.	......	......
10:35 a. m...	44.8	7.1	58	s.	12	5.4	9,197	2,803	38.5	3.6	....	w.	......	......
11:59 a. m...	51.5	10.8	49	se.	12	5.4	10,820	3,298	33.3	0.7	....	wsw.	......	......
12:27 p. m...	52.8	11.6	46	se.	12	5.4	7,513	2,290	44.6	7.0	....	wsw.	......	......
12:52 p. m...	54.2	12.3	43	se.	12	5.4	2,983	909	51.8	11.0	....	ssw.	......	......
12:56 p. m...	54.1	12.3	44	se.	12	5.4	2,848	868	45.9	7.7	....	sse.	......	......
1:02 p. m...	54.1	12.3	44	sse.	12	5.4	1,725	526	54.1	12.3	44	sse.	12	5.4

October 21, 1907.—Three kites having a total lifting surface of 204 ft. (18.9 sq. m.) were used. Wire out, 12,500 ft. (3,810 m.); at the maximum altitude, 10,000 ft. (3,200 m.).

At the beginning of the flight a few St.-Cu. clouds were moving from the north; Cu. clouds from the same direction appeared later.

High pressure covered practically all of the United States, being central over the region between the Ohio River and the Great Lakes. An area of low pressure lay in the Canadian Northwest.

October 22, 1907.—Four kites having a total lifting surface of 248 sq. ft. (22.9 sq. m.) were used. Wire out, 15,000 ft. (4,572 m.); at the maximum altitude reached, 12,500 ft. (3,810 m.).

The few Ci. clouds present at the beginning of the flight had so increased as to cover one-third of the sky by the end of the flight; an upper layer was moving from the west, while a lower layer came from the southwest.

High pressure was moving eastward over the middle Atlantic coast, and another high was central over western Wyoming. Low pressure was central just north of Lake Superior.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity	
Oct. 23, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
11:10 a. m...	62.8	17.1	48	w.	12	5.4	1,725	526	62.8	17.1	48	w.	12	5.4
11:40 a. m...	64.0	17.8	43	w.	12	5.4	2,848	866	58.3	14.6	....	w.	......	......
12:09 p. m...	61.0	16.1	50	wnw.	12	5.4	3,952	1,205	49.6	9.8	....	wnw.	......	......
12:30 p. m...	62.0	16.7	50	wnw.	12	5.4	4,905	1,495	44.8	7.1	...	wnw.	......	......
1:12 p. m...	60.2	15.7	53	nw.	12	5.4	6,914	2,107	39.2	4.0	....	nw.	......	......
1:30 p. m...	59.7	15.4	53	nw.	12	5.4	2,906	886	49.1	9.5	....	nw.	......	......
1:50 a. m...	59.3	15.2	....	nw.	12	5.4	1,725	526	59.3	15.2	....	nw.	12	5.4
Oct. 24, 1907.														
8:34 a. m...	32.0	0.0	69	nw.	......	......	1,725	526	32.0	0.0	69	nw.	......	......
8:39 a. m...	32.0	0.0	69	nw.	......	......	3,528	1,075	30.7	− 0.7	....	nw.	......	......
10:26 a. m...	40.0	4.4	53	nw.	......	......	3,757	1,145	33.8	1.0	....	nne.	......	......
11:20 a. m...	39.7	4.3	50	nw.	......	......	2,649	808	34.2	1.2	....	nw.	......	......
11:31 a. m...	39.0	3.9	50	nw.	......	......	1,725	526	39.0	3.9	50	nw.	......	......
Oct. 25, 1907.														
8:25 a. m...	49.2	9.6	....	w.	12	5.4	1,725	526	49.2	9.6	....	w.	12	5.4
9:00 a. m...	52.0	11.1	36	w.	12	5.4	4,087	1,246	51.4	10.8	....	nw.	......	......
9:07 a. m...	52.5	11.4	41	w.	12	5.4	5,245	1,599	48.6	9.2	....	nw.	......	......
9:42 a. m...	54.8	12.7	34	w.	12	5.4	6,780	2,051	43.2	6.2	....	wnw.	......	......
10:00 a. m...	55.6	13.1	....	w.	12	5.4	8,051	2,454	35.8	2.1	....	wnw.	......	......
10:15 a. m...	57.0	13.9	27	w.	12	5.4	9,671	2,948	31.1	− 0.5	....	wnw.	......	
10:42 a. m...	58.0	14.4	30	w.	12	5.4	10,957	3,340	26.2	− 3.2	....	wnw.	......	......
11:15 a. m...	60.0	15.6	27	w.	12	5.4	9,775	2,979	32.5	0.3	....	wnw.	......	......
11:45 a. m...	60.5	15.8	....	w.	12	5.4	7,378	2,249	39.2	4.0	....	wnw.	......	......
12:05 p. m...	61.7	16.5	....	se.	8	3.4	5,253	1,601	49.5	9.7	....	......	......	......
12:20 p. m...	58.0	14.4	42	se.	8	3.4	1,725	526	58.0	14.4	42	se.	8	3.4

October 23, 1907.—Two kites having a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out, 8,000 ft. (2,438 m.) at the maximum altitude reached, 7,200 ft. (2,195 m.).

At the beginning of the flight a few St.-Cu. clouds were moving from the west. The clouds increased rapidly and covered the sky from noon until the end of the flight.

Moderately high pressure prevailed over the greater part of the country, with pressure somewhat higher over Lake Superior. Low-pressure areas were central over the lower St. Lawrence and in northwest Canada.

October 24, 1907.—Three kites having a lifting surface of 204 sq. ft. (18.9 sq. m.) were used. Wire out at the maximum altitude, 6,000 ft. (1,829 m.).

During the flight the sky was clear; the wind was brisk until 9 a. m. and was fresh thereafter.

High pressure occupied the greater part of the United States, with centers north of Montana and over the lower Lakes. An area of low pressure was north of Lake Superior.

October 25, 1907.—Two kites having a lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out, 20,000 ft. (6,096 m.), at the maximum altitude attained, 19,500 ft. (5,944 m.).

At the beginning of the flight the sky was about half covered with A.-Cu. clouds moving from the northwest. Cloudiness soon decreased to one or two tenths, made up of Ci.-Cu., A.-Cu., and St.-Cu., all coming from the west. This direction held until the end of the flight, tho about half of the sky was again covered between 11 a. m. and noon.

An area of moderately high pressure was central over North Carolina, while a greater area was over the Dakotas. Low pressure areas were central over the lower St. Lawrence and in the Canadian northwest.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Oct. 26, 1907.	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*
4:04 p. m...	45.0	7.2	52	se.	......	......	1,725	526	45.0	7.2	52	se.	......	......
4:32 p. m...	44.0	6.7	46	se.	......	......	2,882	878	39.6	4.2	....	sse.	......	......
4:50 p. m...	43.0	6.1	49	se.	......	......	3,039	926	44.6	7.0	....	s.	......	......
5:21 p. m...	41.0	5.0	54	se.	......	......	1,725	526	41.0	5.0	54	se.	......	......
Oct. 28, 1907.														
9:25 a. m...	41.0	5.0	89	nw.	......	......	1,725	526	41.0	5.0	89	nw.	......	......
9:40 a. m...	41.0	5.0	88	nw.	......	......	3,907	1,191	33.8	1.0	....	nnw.	......	......
10:00 a. m...	41.0	5.0	86	nw.	......	......	1,725	526	41.0	5.0	86	nw.	......	......
Oct. 29, 1907.														
4:22 p. m...	49.5	9.7	28	nw.	36	16.1	1,725	526	49.5	9.7	28	nw.	36	16.1
4:26 p. m...	48.9	9.4	28	nw.	36	16.1	4,171	1,271	39.9	4.4	....	wnw.	......	......
4:32 p. m...	48.6	9.2	29	nw.	36	16.1	5,525	1,683	33.8	1.0	....	wnw.	......	......
4:47 p. m...	48.5	9.2	30	nw.	36	16.1	1,725	526	48.5	9.2	30	nw.	36	16.1
Oct. 30, 1907.														
7:51 a. m...	35.0	1.7	78	nw.	......	......	1,725	526	35.0	1.7	78	nw.	......	......
8:25 a. m...	35.8	2.1	72	nw.	......	......	4,304	1,312	42.3	5.7	....	nnw.	......	......
9:08 a. m...	37.5	3.1	70	nw.	......	......	6,478	1,974	38.1	3.4	....	n.	......	......
9:58 a. m...	39.6	4.2	68	nw.	......	......	9,670	2,948	31.3	− 0.4	....	nnw.	......	......
10:37 a. m...	40.2	4.6	63	nw.	......	......	6,289	1,917	39.2	4.0	....	n.	......	......
11:10 a. m...	42.0	5.6	57	nw.	......	......	4,286	1,306	41.5	5.3	....	n.	......	......
11:16 a. m. .	41.7	5.4	55	nw.	......	......	3,230	984	34.5	1.4	....	nnw.	......	......
11:40 a. m...	41.8	5.4	57	nw.	......	......	1,725	526	41.8	5.4	55	nw.	......	......

October 26, 1907.—Two kites having a lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out, 5,000 ft. (1,524 m.); at the maximum altitude attained, 4,250 ft. (1,295 m.).

The sky was partly covered with Ci.-Cu. clouds from the west.

At 8 a. m. high pressure was central north of the lower Lakes, whence the pressure decreased rapidly toward the Gulf of St. Lawrence, and more slowly to a low over Arkansas and Oklahoma.

October 28, 1907.—One kite having a lifting surface of 55 sq. ft. (5.1 sq. m.) was used. Wire out, 3,000 ft. (914 m.), at the maximum altitude reached.

The sky was covered with St. clouds moving from the northwest thruout the day. A moderate rain had fallen late in the preceding night, and light rain fell just before the flight.

A large area of high pressure occupied the Mississippi Valley, while a low area, central over southern New Jersey, covered the middle Atlantic coast. Rain or snow was falling from Virginia northward to the St. Lawrence.

October 29, 1907.—One kite having a lifting surface of 68 sq. ft. (63 sq. m.) was used. Wire out, 8,000 ft. (2,438 m.); at the maximum altitude attained, 6,500 ft. (1,981 m.).

One-tenth Ci. clouds moving from the northwest.

At 8 a. m. high pressure occupied the greater part of the eastern United States, with pressure somewhat higher over Lake Superior and over Kentucky. Low pressure was central over Long Island Sound.

October 30, 1907.—Two kites having a lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out at the maximum altitude, 13,500 ft. (4,115 m.).

The sky was clear at the beginning of the flight; partly covered with Ci. after 9 a. m., and nearly covered with Ci. and Ci.-St. after 10 a. m.; all clouds were moving from the northwest.

High pressure, central over the Lakes, extended over the eastern United States. An area of low pressure covered Nova Scotia.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Oct. 31, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
5:03 p. m...	39.0	3.9	44	e.	11	4.9	1,725	526	39.0	3.9	44	e.	11	4.9
5:35 p. m...	39.3	4.1	46	e.	12	5.4	2,786	849	36.1	2.3	....	se.	......	......
5:56 p. m...	39.5	4.2	48	e.	12	5.4	3,591	1,095	44.6	7.0	....	s.	......	......
6:26 p. m...	39.8	4.3	47	e.	13	5.8	5,440	1,658	36.0	2.2	....	s.	......	......
6:42 p. m...	39.5	4.2	49	e.	13	5.8	2,937	895	46.4	8.0	....	se.	......	......
6:45 p. m...	39.6	4.2	50	e.	13	5.8	2,507	764	38.5	3.6	....	ese.	......	......
6:50 p. m...	39.3	4.1	52	e.	14	6.3	1,725	526	39.3	4.1	52	e.	14	6.3
Nov. 1, 1907.														
9:48 a. m...	40.3	4.6	71	se.	12	5.4	1,725	526	40.3	4.6	71	se.	12	5.4
10:05 a. m...	42.2	5.7	74	se.	12	5.4	2,997	913	41.4	5.2	....	sse.	......	......
10:24 a. m...	43.5	6.4	70	se.	12	5.4	4,077	1,243	42.3	5.7	....	s.	......	......
10:48 a. m...	43.7	6.5	71	se.	12	5.4	4,825	1,471	42.6	5.9	....	ssw.	......	......
12:22 p. m...	49.0	9.4	55	se.	12	5.4	6,422	1,958	37.6	3.1	....	sw.	......	......
1:32 p. m...	48.4	9.1	55	se.	12	5.4	7,358	2,243	31.1	− 0.5	....	sw.	......	......
2:28 p. m...	48.0	8.9	60	se.	14	6.3	8,206	2,501	29.7	− 1.3	....	sw.	......	......
2:38 p. m...	47.5	8.6	59	se.	16	7.2	6,420	1,957	36.7	2.6	....	wsw	......	......
2:49 p. m...	47.5	8.6	62	se.	16	7.2	5,170	1,576	39.7	4.3	....	sw.	......	......
3:01 p. m...	47.6	8.7	62	se.	16	7.2	3,689	1,124	45.8	7.4	....	s.	......	......
3:10 p. m ..	47.9	8.8	61	se.	16	7.2	2,838	865	41.5	5.3	....	sse.	......	......
3:19 p. m...	47.4	8.6	64	se.	16	7.2	1,725	526	47.4	8.6	64	se.	16	7.2
Nov. 2, 1907.														
3:40 p. m...	48.1	8.9	100	wnw.	24	10.7	1,725	526	48.1	8.9	100	wnw.	24	10.7
3:50 p. m...	48.1	8.9	100	nw.	24	10.7	3,630	1,106	46.8	8.2	....	w.	......	......
4:22 p. m...	48.0	8.9	100	wnw.	24	10.7	5,069	1,545	45.3	7.4	....	sw.	......	......
4:35 p. m...	48.5	9.2	97	wnw.	24	10.7	3,651	1,113	47.8	8.8	....	wsw.	......	......
4:45 p. m...	49.2	9.6	96	wnw.	24	10.7	2,822	860	52.7	11.5	....	wsw.	......	......
4:55 p. m...	49.4	9.7	94	wnw.	24	10.7	1,725	526	49.4	9.7	94	wnw.	24	10.7

October 31, 1907.—Three kites having a lifting surface of 210 sq. ft. (19.4 sq. m.) were used. Wire out, 6,500 ft. (1,981 m.); at the maximum altitude, 5,000 ft. (1,524 m.).

At the beginning of the flight three-fourths of the sky was covered with Ci.-St. clouds, apparently without direction, and some Cu. clouds were moving from the east. Lower clouds increased rapidly and covered the sky by 6 p. m. Light snow fell at intervals after 6:33 p. m.

At 8 a. m. an area of high pressure, central over New York and eastern Pennsylvania, covered the eastern United States, while an area of low pressure, central in northwest Canada, extended southward behind the high.

November 1, 1907.—Four kites having a total lifting surface of 278 sq. ft. (25.7 sq. m.) were used. Wire out, 13,500 ft. (4,115 m.); at the maximum altitude, 10,800 ft. (3,292 m.).

The few Ci.-St. and A.-St. clouds that were moving across the sky, from the northwest and the southwest, respectively, during the early part of the flight, increased so as to partly cover the sky by 10:45 a. m. Ci.-St., moving from the northwest, covered the sky after 12:45 p. m.

High pressure, central over Massachusetts, extended along the Atlantic coast. A trough of low pressure stretched from the upper Mississippi Valley nearly to the Gulf.

November 2, 1907.—Two kites having a total lifting surface of 66 sq. ft. (6.1 sq. m.) were used. Wire out, 7,500 ft. (2,286 m.); at the maximum altitude, 7,000 ft. (2,134 m.).

The light fog and rain prevalent at beginning of the flight gradually diminished, the rain ending at 4 p. m. and the fog at 4:30 p. m. The clouds were low and came from the southwest. Six-tenths St.-Cu. were present at the end of the flight.

One high pressure area lay east of New England, while another extended over the Rocky Mountain slope. An area of low pressure was central over Lake Huron.

RESULTS OF CAPTIVE BALLOON ASCENSIONS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
Nov. 4, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
5:08 p. m...	46.5	8.1	55	w.	4	1.8	1,725	526	46.5	8.1	55	w.	4	1.8
5:17 p. m...	44.5	6.9	52	w.	4	1.8	4,335	1,321	35.2	1.8	....	ssw.	......	......
5:34 p. m...	43.9	6.6	54	ssw.	4	1.8	3,044	928	41.0	5.0	....	ssw.	......	......
5:45 p. m...	44.0	6.7	54	ssw.	4	1.8	2,671	814	43.2	6.2	....	ssw:	......	......
5:48 p. m...	44.0	6.7	52	ssw.	4	1.8	1,725	526	44.0	6.7	52	ssw.	4	1.8
Nov. 5, 1907.														
11:09 a. m...	54.5	12.5	54	ssw.	6	2.7	1,725	526	54.5	12.5	54	ssw.	6	2.7
11:15 a. m...	54.0	12.2	51	s.	7	3.1	3,618	1,103	47.3	8.5	....	ssw.	......	......
11:20 a. m..	53.5	11.9	48	s.	8	3.6	4,513	1,376	38.5	3.6	....	wsw.	......	......
11:32 a. m...	54.0	12.2	....	sse.	8	3.6	2,821	860	46.0	7.8	....	ssw.	......	......
12:25 p. m...	57.4	14.1	49	ssw.	10	4.5	1,725	526	57.4	14.1	49	ssw.	10	4.5

RESULTS OF KITE FLIGHT.

Nov. 6, 1907.														
10:50 a. m...	40.7	4.8	96	nw.	14	6.3	1,725	526	40.7.	4.8	96	nw.	14	6.3
11:40 a. m...	39.6	4.2	100	nw.	14	6.3	2,618	798	44.8	7.1	....	nnw.	......	......
12:19 p. m...	39.9	4.4	100	nw.	14	6.3	3,887	1,082	42.6	5.9	....	nw.	......	......
1:19 p. m...	41.5	5.3	96	nw.	16	7.2	3,881	1,183	40.3	4.6	....	ne.	......	......
1:54 p. m...	41.4	5.2	96	nw.	14	6.3	5,233	1,595	32.0	0.0	....	ne.	......	......
2:08 p. m...	41 4	5.2	97	nw.	16	7.2	5,983	1,824	28.8	− 1.8	....	ne.	......	......
2:34 p. m...	41.5	5.3	100	nw.	18	8.0	6,973	2,125	25.5	− 3.6	....	ne.	......	......
2:55 p. m...	41.4	5.2	100	nw.	24	10.7	8,004	2,470	23.2	− 4.9	....	nnw.	......	......
3:02 p. m..	41.4	5.2	100	nw.	24	10.7	5,918	1,802	27.0	− 2.8	....	nnw.	......	......
3:20 p. m...	41.4	5.2	100	nw.	35	15.6	4,789	1,460	28.6	− 1.9	....	nnw.	......	......
3:30 p. m...	40.9	4.9	100	nw.	35	15.6	1,725	526	40.9	4.9	100	nw.	35	15.6

November 4, 1907.—The flight was made with three captive balloons. Wire out, 7,000 ft. (2,134 m.); at maximum altitude, 6,500 ft. (1,981 m.).

A few Ci. clouds were moving from the west-southwest.

At 8 a. m. pressure was moderately high over the South Atlantic and Gulf States. A marked low was passing eastward over the Gulf of St. Lawrence, while a lesser low was over Lake Superior.

November 5, 1907.—Three captive balloons were used in the flight. Wire out, 7,400 ft. (2,256 m.) at the maximum altitude.

Four-fifths of the sky was covered with A.-St. and A.-Cu., moving from the southwest, but Ci.-St. clouds prevailed during the greater part of the flight.

Pressure was high over the western half of the country, and was low over the eastern part, with moderately low areas central over the Lakes and over southern Florida.

November 6, 1907.—Three kites having a total lifting surface of 210 sq. ft. (19.4 sq. m.) were used. Wire out, 12,000 ft. (3,658 m.); at the maximum altitude, 9,300 ft. (2,835 m.).

The first kite launched soon disappeared in the prevailing light fog. The fog was dense, except at short intervals, from 11:15 a. m. until 12:44 p. m., when it became light, and St. clouds moving from the north were observed. These gradually gave place to St.-Cu. from the northwest. Kites were occasionally visible for very short intervals. At 1.55 p. m. light rain began; dense fog soon set in and the wind rose rapidly. Fog, rain, and high wind continued to the end of the flight.

Pressure was high over Nova Scotia, while this station lay in the center of a considerable area of low pressure that had caused light rain over the Atlantic States and the Lake region.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Nov. 7, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
3:07 p.m...	41.7	5.4	49	wnw.	35	15.6	1,725	526	41.7	5.4	49	wnw.	35	15.6
3:10 p.m..	41.5	5.3	48	wnw.	34	15.2	3,531	1,076	34.5	1.4	....	wnw.	......	......
3:20 p.m..	41.4	5.2	47	wnw.	32	14.3	4,362	1,330	26.6	− 3.0	....	wnw.	......	......
3:41 p.m...	41.0	5.0	47	wnw.	28	12.5	6,221	1,896	22.6	− 5.2	....	nw.	......	......
3:47 p.m...	40.9	4.9	47	wnw.	27	12.1	6,756	2,059	26.6	− 3.0	....	nw.	......	......
4:08 p.m...	40.6	4.8	50	wnw.	27	12.1	6,335	1,931	23.0	− 5.0	....	wnw.	......	......
4:17 p.m...	40.3	4.6	50	wnw.	27	12.1	5,924	1,806	23.0	− 5.0	....	wnw.	......	......
4:35 p.m...	40.0	4.4	50	wnw.	28	12.5	4,610	1,405	24.4	− 4.2	....	wnw.	......	......
4:58 p.m...	39.0	3.9	53	wnw.	28	12.5	3,327	1,014	30.6	− 0.8	....	wnw.	......	......
5:20 p.m...	38.0	3.3	51	wnw.	30	13.4	1,725	526	38.0	3.3	51	wnw.	30	13.4
Nov. 8, 1907.														
9:27 a.m...	40.5	4.7	52	s.	11	4.9	1,725	526	40.5	4.7	52	s.	11	4.9
9:44 a.m...	41.0	5.0	47	s.	11	4.9	2,946	898	40.8	4.9	....	wsw.	......	......
9:59 a.m...	41.4	5.2	47	s.	11	4.9	4,212	1,284	45.0	7.2	....	w.	......	......
10:10 a.m...	41.0	5.0	48	s.	11	4.9	4,642	1,415	44.2	6.8	....	w.	......	......
10:20 a.m...	41.0	5.0	50	se.	14	6.3	6,054	1,845	39.2	4.0	....	w.	......	......
10:35 a.m...	41.5	5.3	51	s.	18	8.0	7,396	2,254	35.6	2.0	....	w.	......	......
11:05 a.m...	41.6	5.3	48	s.	18	8.0	9,426	2,873	26.6	− 3.0	....	w.	......	......
11:56 a.m...	42.0	5.6	49	s.	16	7.2	11,544	3,519	24.4	− 4.2	....	w.	......	......
12:11 p.m.	42.0	5.6	49	s.	16	7.2	8,114	2,473	32.0	0.0	....	w.	......	......
1:30 p.m...	44.8	7.1	48	s.	12	5.4	8,684	2,647	27.3	− 2.6	....	wnw.	......	......
2:00 p.m...	45.4	7.4	52	sse.	12	5.4	7,228	2,202	33.8	1.0	....	w.	......	......
2:23 p.m...	45.4	7.4	55	sse.	12	5.4	4,788	1,458	47.3	8.5	....	wsw.	......	......
2:40 p.m...	45.0	7.2	55	sse.	12	5.4	2,616	797	54.5	12.5	....	sw.	......	......
3:00 p.m...	45.0	7.2	55	sse.	12	5.4	1,725	526	45.0	7.2	55	sse.	12	5.4

November 7, 1907.—Two kites with a total lifting surface of 77 sq. ft. (7.2 sq. m.) were used. Wire out, 10,000 ft. (3,048 m.); at the maximum altitude, 8,500 ft. (2,591 m.).

The wind had been blowing a gale all day and was still high at the time of the flight. The sky was clear, save for a few Cu. clouds moving from the west-northwest.

At 8 a. m. moderately high pressure lay over the Gulf States, while a low of marked intensity was central over the upper St. Lawrence and dominated the region north of Virginia and east of the Lakes.

November 8, 1907.—Four kites having a total lifting surface of 242 sq. ft. (22.4 sq. m.) were used. Wire out, 25,000 ft. (7,620 m.); at the maximum altitude, 24,750 ft. (7,544 m.).

St.-Cu., moving from the northwest until 9:30 a. m., from the west thereafter, nearly covered the sky until about 11 a. m., when they were succeeded by St. Light rain fell from 11:47 a. m. until noon. After 12:30 p. m. the lower clouds gradually gave way to A.-Cu. from the west, there being about half of each kind present at the end of the flight. The leading kite past into the St.-Cu. clouds about 10:51 a. m., at about 8,800 ft. (2,682 m.), and was observed in rifts between the clouds at heights of 9,200 ft. (2,804 m.) and 9,800 ft. (2,987 m.).

Areas of high pressure were central over Florida and Nebraska, while a trough of low pressure extended from Texas over the Ohio Valley to the Gulf of St. Lawrence.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
	° F.	*° C.*	*%*		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	*° F.*	*° C.*	*%*		*Miles p. h.*	*Met's p. s.*
Nov. 9, 1907.														
10:10 a. m...	49.0	9.4	61	se.	12	5.4	1,725	526	48.9	9.4	61	se.	12	5.4
10:40 a. m...	49.0	9.4	64	se.	12	5.4	2,983	909	52.7	11.5	....	sw.	......	......
10:53 a. m...	49.0	9.4	61	se.	12	5.4	3,866	1,178	47.3	8.5	....	sw.	......	......
11:10 a. m...	49.0	9.4	60	se.	14	6.3	5,379	1,640	41.0	5.0	....	w.	......	......
11:28 a. m...	49.8	9.9	64	se.	14	6.3	6,229	1,899	39.4	4.1	....	wnw.	......	......
11:39 a. m...	52.0	11.1	63	se.	14	6.3	7,352	2,241	36.9	2.7	....	wnw.	......	......
11:52 a. m...	53.1	11.7	64	se.	14	6.3	8,220	2,506	35.8	2.1	....	w.	......	......
12:28 p. m...	53.3	11.8	67	s.	14	6.3	10,330	3,149	27.5	− 2.5	....	w.	......	......
12:40 p. m...	53.8	12.1	65	s.	14	6.3	8,955	2,130	32.5	0.3	....	w.	......	......
2:01 p. m...	52.5	11.4	69	se.	14	6.3	6,319	1,926	37.9	3.3	....	w.	......	......
2:20 p. m...	52.0	11.1	72	sse.	14	6.3	4,338	1,322	47.5	8.6	....	wsw.	......	......
2:37 p. m...	51.5	10.8	69	sse.	14	6.3	3,067	935	54.0	12.2	....	sw.	......	......
3:00 p. m...	53.0	11.7	70	sse.	14	6.3	1,725	526	53.0	11.7	70	sse.	14	6.3
Nov. 11, 1907.														
7:20 a. m...	34.0	1.1	58	nw.	15	6.7	1,725	526	34.0	1.1	58	nw.	15	6.7
7:48 a. m...	34.8	1.6	55	nw.	15	6.7	2,954	900	28.6	− 1.9	....	nw.	......	......
7:57 a. m...	34.8	1.6	55	nw.	15	6.7	4,050	1,235	24.4	− 4.2	....	nw.	......	......
8:10 a. m...	35.0	1.7	55	nw.	15	6.7	5,424	1,653	20.1	− 6.6	....	wnw.	......	......
8:18 a. m...	34.4	1.3	54	nw.	16	7.2	6,361	1,939	20.1	− 6.6	....	wnw.	......	......
8:40 a. m...	35.0	1.7	55	nw.	18	8.0	6,675	2,034	30.0	− 1.1	....	wsw.	......	......
9:20 a. m...	35.0	1.7	55	nw.	18	8.0	8,569	2,612	26.8	− 2.9	....	wsw.	......	......
9:40 a. m...	35.0	1.7	55	nw.	19	8.5	9,496	2,894	19.9	− 6.7	....	wsw.	......	......
11:10 a. m...	37.5	3.1	46	nw.	20	8.9	1,725	526	37.5	3.1	46	nw.	20	8.9

November 9, 1907.—Two kites having a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out, 20,000 ft. (6,096 m.); this was also the length of wire at the maximum altitude.

High clouds from the west, nearly covering the sky at the beginning of the flight, had given place to St. from the southwest by about 11:30 a. m. After about 2 p. m. the St. was gradually displaced by A.-St. and Ci., both from the west, and St.-Cu. from the southwest. The head kite was obscured by clouds for a minute or two at 11:49 a. m., 12:32 and 12:49 p. m.

Areas of high pressure were central over Florida and Washington and a large area of low pressure was central over Lake Superior.

November 11, 1907.—Two kites having a lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 20,000 ft. (6,096 m.); at the maximum altitude, 19,000 ft. (5,791 m.).

At the beginning of the flight the sky was nearly covered with A.-Cu. clouds from the west-southwest. These clouds decreased to 3/10 by 8:40 a. m. The sky was overcast with St. from the west-southwest at 11 a. m.

An area of unusually high pressure was central over North Dakota and extended over practically all the United States.

RESULTS OF CAPTIVE BALLOON ASCENSION.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Nov. 12, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:12 p. m...	33.5	0.8	76	o	0	0	1,725	526	33.5	0.8	76	o	0	0
2:28 p. m...	33.0	0.6	61	o	0	0	3,915	1,193	29.8	− 1.2	....	o	......	......
2:33 p. m...	32.9	0.5	62	c	0	0	6,267	1,910	22.6	− 5.2	....	o	......	......
2:41 p. m...	32.8	0.4	63	o	0	0	7,486	2,283	20.8	− 6.2	....	o	......	......
2:50 p. m...	33.0	0.6	64	o	0	0	6,721	2,049	17.6	− 8.0	....	o	......	......
3:16 p. m...	32.6	0.3	68	o	0	0	4,302	1,311	22.6	− 5.2	....	o	......	......
3:40 p. m...	32.8	0.4	64	s.	2	0.9	2,790	850	24.8	− 4.0	....	s.	......	......
4:05 p. m...	33.0	0.6	66	s.	2	0.9	1,725	526	33.0	0.6	66	s.	2	0.9

RESULTS OF KITE FLIGHTS.

Date and hour.	° F.	° C.	Rel. hum.	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	Rel. hum.	Dir.	Miles p. h.	Met's p. s.
Nov. 13, 1907														
7:20 a. m...	25.2	−3.8	95	nw.	11	4.9	1,725	526	25.2	− 3.8	95	nw.	11	4.9
7:48 a. m...	25.6	−3.6	94	nw.	11	4.9	2,915	880	23.4	− 4.8	....	nnw.	......	......
7:58 a. m...	26.0	−3.3	93	nw.	9	4.0	3,838	1,170	19.4	− 7.0	....	nnw.	......	......
8:12 a. m...	26.6	−3.0	92	nw.	11	4.9	4,643	1,415	16.0	− 8.9	....	nnw.	......	......
9:29 a. m...	30.2	−1.0	74	nw.	15	6.7	6,265	1,910	8.2	−13.2	....	nw.	......	.....
9:31 a. m..	30.3	−0.9	78	nw.	15	6.7	6,164	1,879	7.7	−13.5	....	nw.	......	......
9:43 a. m...	31.0	−0.6	74	nw.	16	7.2	4,919	1,499	13.8	−10.4	....	nw.	......	......
9:51 a. m...	31.0	−0.6	69	nw.	17	7.6	3,411	1,040	20.1	− 6.6	....	nw.	......	......
10:00 a. m...	31.1	−0.6	69	nw.	17	7.6	1,725	526	31.0	− 0.6	69	nw.	17	7.6
2d flight.														
10:42 a. m...	33.0	0.6	63	nw.	18	8.0	1,725	526	33.0	0.6	63	nw.	18	8.0
10:50 a. m...	32.5	0.3	60	nw.	18	8.0	3,675	1,120	21.6	− 5.8	....	nw.	......	......
11:16 a. m...	33.0	0.6	61	nw.	20	8.9	5,358	1,632	12.7	−10.7	....	nw.	......	......
11:22 a. m...	33.0	0.6	57	nw.	20	8.9	6,527	1,989	9.3	−12.6	....	nw.	......	......
12:08 p. m...	33.3	0.7	56	nw.	20	8.9	8,528	2,598	17.6	− 8.0	....	nw.	......	......
12:22 p. m...	33.2	0.7	55	nw.	20	8.9	10,378	3,163	9.0	−12.8	....	nw.	......	......
1:30 p. m...	37.0	2.8	58	nw.	19	8.5	13,575	4,138	7.7	−13.5	....	nw.	......	......
2:10 p. m...	37.3	2.9	42	nw.	19	8.5	15,875	4,840	−1.8	−18.8	....	nw.	......	......
3:04 p. m...	38.0	3.3	51	nw.	20	8.9	14,659	4,468	3.7	−15.7	....	nw.	......	......
3:47 p. m...	37.1	2.8	53	nw.	17	7.6	12,919	3,938	8.8	−12.9	....	nw.	......	......
4:30 p. m...	36.0	2.2	48	wnw.	14	6.3	10,341	3,152	18.1	− 7.7	....	nw.	......	......
5:00 p. m...	34.6	1.4	49	wnw.	13	5.8	8,612	2,625	22.1	− 5.5	....	nw.	......	......
5:25 p. m...	33.5	0.8	51	wnw.	12	5.4	5,498	1,676	26.1	− 3.3	....	nw.	......	......
5:38 p. m...	33.0	0.6	54	wnw.	11	4.9	5,061	1,543	19.8	− 6.8	....	wnw.	......	......
5:45 p. m...	32.8	0.4	56	wnw.	11	4.9	3,778	1,152	24.1	− 4.4	....	wnw.	......	......
5:51 p. m...	32.5	0.3	60	wnw.	11	4.9	3,036	926	27.9	− 2.3	....	wnw.	......	......
6:13 p. m...	32.4	0.2	....	wnw.	10	4.5	1,725	526	32.4	0.2	....	wnw.	10	4.5

November 12, 1907.—Three captive balloons were used in this flight. Wire out, 6,350 ft. (1,936 m.); at the maximum altitude, 6,000 ft. (1,829 m.).

Light snow fell during the entire flight.

High pressure, central over Kansas, extended over almost the whole United States.

November 13, 1907.—First flight: Two kites having a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used; wire out, 9,700 ft. (2,957 m.); at the maximum altitude, 6,750 ft. (2,057 m.).

The few St. clouds present at the beginning of the flight had given place to five-tenths A.-Cu. from the northwest by the end.

Second flight: Four kites with a total lifting surface of 278 sq. ft. (25.7 sq. m.) were used. Wire out, 30,000 ft. (9,144 m.); at the maximum altitude, 28,000 ft. (8.534 m.).

The sky was partly covered with St.-Cu. from the northwest until just before 1 p. m., and was clear thereafter.

The head kite was passing thru clouds from 11:16 to 11:22 a. m.

At 8 a. m. pressure was high over the lower Mississippi Valley, and was low over the Lake region, with a secondary low off the North Carolina coast.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Nov. 14, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:10 a. m...	29.0	−1.7	58	nw.	17	7.6	1,725	526	29.0	− 1.7	58	nw.	17	7.6
7:38 a. m...	29.0	−1.7	61	nw.	17	7.6	2,745	837	23.7	− 4.6	....	nw.	......	......
7:48 a. m...	29.0	−1.7	61	nw.	17	7.6	3,687	1,124	20.3	− 6.5	....	nw.	......	......
7:58 a. m...	29.0	−1.7	61	nw.	19	8.5	4,511	1,375	18.5	− 7.5	....	nw.	......	......
8:15 a. m...	29.5	−1.4	62	nw.	21	9.4	5,537	1,688	14.0	−10.0	....	nw.	......	......
9:48 a. m...	32.4	0.2	69	nw.	22	9.8	6,940	2,115	27.5	− 2.5	....	wnw.	......	......
10:00 a. m...	31.8	−0.1	69	nw.	23	10.3	8,278	2,523	24.3	− 4.3	....	wnw.	......	......
10:22 a. m...	32.6	0.3	68	nw.	23	10.3	7,253	2,211	20.3	− 6.5	....	wnw.	......	......
10:38 a. m...	32.8	0.4	59	nw.	23	10.3	6,105	1,861	20.3	− 6.5	....	wnw.	......	......
10:45 a. m..	33.0	0.6	59	nw.	23	10.3	5,034	1,534	14.4	− 9.8	....	wnw.	......	......
11:10 a. m...	34.6	1.4	75	nw.	23	10.3	1,725	526	34.6	1.4	75	nw.	23	10.3
Nov. 15, 1907														
7:30 a. m...	29.5	−1.4	74	sse.	8	3.6	1,725	526	29.5	− 1.4	74	sse.	8	3.6
7:41 a. m..	30.0	−1.1	....	sse.	8	3.6	2,839	865	29.1	− 1.6	....	ssw.	......	......
7:55 a. m...	30.9	−0.6	....	sse.	8	3.6	3,757	1,145	30.2	− 1.0	....	sw.	......	......
8:29 a. m...	33.0	0.6	61	sse.	8	3.6	6,234	1,900	23.4	− 4.8	....	w.	......	......
9:19 a. m...	34.8	1.6	60	sse.	8	3.6	8,006	2,440	21.9	− 5.6	....	w.	......	......
10:20 a. m...	37.0	2.8	58	sse.	9	4.0	10,816	3,297	16.9	− 8.4	....	w.	......	......
11:47 a. m...	39.5	4.2	57	sse.	9	4.0	13,638	4,157	8.1	−13.3	....	w.	......	......
1:26 p. m...	43.5	6.4	54	sse.	7	3.1	14,088	4,294	5.7	−14.6	....	w.	......	......
2:03 p. m...	44.0	6.7	55	sse.	6	2.7	10,758	3,279	17.4	− 8.1	....	w.	......	......
2:24 p. m...	44.0	6.7	52	sse.	5	2.2	8,009	2,441	24.4	− 4.2	....	w.	......	......
2:34 p. m..	43.4	6.3	51	sse.	5	2.2	6,326	1,928	24.4	− 4.1	....	w.	......	......
3:00 p. m...	43.3	6.4	54	sse.	5	2.2	1,725	526	43.5	6.4	54	sse.	5	2.2

RESULTS OF CAPTIVE BALLOON ASCENSION.

Nov. 16, 1907														
4:39 p. m...	42.0	5.6	50	wnw.	6	2.7	1,725	526	42.0	5.6	50	wnw.	6	2.7
4:43 p. m...	42.0	5.6	50	wnw.	5	2.7	4,442	1,293	30.6	− 0.8	....	wnw.	......	......
5:12 y. m...	41.0	5.0	50	wnw.	6	2.7	1,725	526	41.0	5.0	50	wnw.	6	2.7

November 14, 1907.—Three kites having a total lifting surface of 204 sq. ft. (18.9 sq. m.) were used. Wire out, 15,000 ft. (4,572 m.); at the maximum altitude, 14,500 ft. (4,420 m.).

From two to five-tenths of St.-Cu. from the west-northwest were present until after 9 a. m., when they decreased to about one-tenth from the northwest.

Pressure was high over the entire Mississippi Valley, whence it decreased to a low over the Gulf of St. Lawrence.

November 15, 1907.—Six kites with a total lifting capacity of 414 sq. ft. (38.3 sq. m.) were used. Wire out, 26,250 ft. (8,001 m.); at the maximum altitude, 22,500 ft. (6,858 m.).

The sky was clear.

A ridge of high pressure extended from Massachusetts to Louisiana, while another area was central over the Dakotas. Somewhat lower pressure extended from the Lakes southwestward to Arizona.

November 16, 1907.—The flight was made with three captive balloons. Wire out, 6,075 ft. (1,852 m.); at the maximum altitude, 6,000 (1,829 m.).

A few A.-St. clouds were moving from the west.

At 8 a. m. high pressure prevailed over the eastern part of the United States, and low pressure was central in the Canadian northwest, with a lesser depression north of Lake Superior.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Nov. 18, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:34 a.m...	32.2	0.1	100	se.	10	4.5	1,725	526	32.2	0.1	100	se.	10	4.5
8:05 a.m...	32.4	0.2	100	se.	10	4.5	2,577	785	33.6	0.9	....	se.	......	......
8:08 a.m...	32.4	0.2	100	se.	10	4.5	3,613	1,101	37.4	3.0	....	se.	......	......
9:10 a.m...	32.0	0.0	100	e.	10	4.5	1,725	526	32.0	0.0	100	e.	10	4.5
Nov. 19, 1907														
7:39 a.m...	35.5	1.9	100	nw.	22	9.8	1,725	526	35.5	1.9	100	nw.	22	9.8
7:56 a.m...	35.7	2.1	100	nw.	21	9.4	2,512	766	31.8	−0.1	....	nnw.	......	......
8:06 a.m...	35.7	2.1	100	nw.	20	8.9	3,167	965	39.6	4.2	....	n.	......	......
8:40 a.m...	36.0	2.2	100	nw.	20	8.9	3,582	1,097	43.0	6.1	....	n.	......	......
9:08 a.m...	36.0	2.2	100	nw.	20	8.9	4,164	1,269	42.4	5.8	....	nne.	......	......
9:24 a.m...	36.5	2.5	100	nw.	20	8.9	3,496	1,066	41.6	5.3	....	n.	......	......
9:30 a.m...	36.8	2.7	100	nw.	20	8.9	2,088	635	34.3	1.3	....	n.	......	......
9:48 a.m...	37.0	2.8	100	nw.	17	7.6	1,725	526	37.0	2.8	100	nw.	17	7.6
2d flight.														
10:08 a.m...	37.4	3.0	97	nnw.	18	8.0	1,725	526	37.4	3.0	97	nnw.	18	8.0
10:20 a.m...	37.8	3.2	97	nnw.	18	8.0	2,454	748	36.5	2.5	....	nne.	......	......
10:25 a.m...	38.6	3.7	....	nnw.	18	8.0	4,366	1,331	42.3	5.7	....	nne.	......	......
10:35 a.m...	39.7	4.3	96	nnw.	18	8.0	4,772	1,454	43.3	6.3	....	nne.	......	......
10:46 a.m...	39.5	4.2	90	nnw.	18	8.0	5,988	1,825	41.9	5.5	....	nne.	......	......
11:05 a.m...	41.8	5.4	85	nnw.	18	8.0	7,162	2,183	29.6	4.2	....	nne.	......	......
12:22 p.m...	46.0	7.8	71	nw.	18	8.0	7,804	2,379	40.8	4.9	....	nne.	......	......
12:42 p.m...	46.0	7.8	70	nw.	18	8.0	6,658	2,029	38.7	3.7	....	nne.	......	......
1:01 p.m...	46.7	8.2	62	nw.	17	7.6	3,915	1,193	42.3	5.7	....	n.	......	......
1:16 p.m...	48.7	9.3	58	nw.	17	7.6	2,783	848	41.0	5.0	....	n.	......	......
1:37 p.m...	47.7	8.7	57	nw.	12	5.4	1,725	526	47.7	8.7	57	nw.	12	5.4

November 18, 1907.—One kite having a lifting surface of 68 sq. ft. (6.3 sq. m.) was used. Wire out, 3,000 ft. (914 m.), at the maximum altitude reached.

Dense fog prevailed during the flight, and rain fell continuously.

Pressure was high along the middle Atlantic and the New England coasts and over North Dakota. Comparatively low pressure was central over Alabama, with the rain area extending from Texas to Pennsylvania.

November 19, 1907.—First flight: One kite having a lifting surface of 55 sq. ft. (5.0 sq. m.) was used. Wire out, 5,000 ft. (1,524 m.), at the time of the maximum altitude.

Dense fog prevailed until 9:30 a. m., then slowly lifted; the sun was visible for a few minutes near the end of the flight.

Second flight: Three kites with a total lifting surface of 204 sq. ft. (18.9 sq. m.) were used. Wire out, 16,500 ft. (5,029 m.); at the maximum altitude, 12,000 ft. (3,658 m.).

At the beginning of the flight the sky was covered with St. clouds from the north-northwest. These had diminished to 2/10 by 11 a. m., and only a few were left by noon. Three-tenths Ci. from the northwest were observed after about 1:15 p. m.

At 10:18 a. m. the leading kite disappeared in the clouds at an elevation of about 400 ft. above the station, and was visible thereafter only at intervals until after 10:30 a. m.

High pressure was central over the Lakes, and a well-defined area of low pressure overlay the Canadian northwest. A secondary low was off the Rhode Island coast.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Nov. 20, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:35 a. m...	33.2	0.7	89	ese.	18	8.0	1,725	256	33.2	0.7	89	ese.	18	8.0
7:52 a. m...	33.0	0.6	90	ese.	18	8.0	2,890	881	29.5	− 1.4	....	ese.	......	......
8:01 a. m...	32.8	0.4	92	ese.	18	8.0	3,755	1,144	30.7	− 0.7	....	se.	......	......
8:30 a. m...	33.0	0.6	92	ese.	19	8.5	5,381	1,640	44.4	6.9	....	se.	......	......
10:27 a. m...	35.0	1.7	86	ese.	19	8.5	7,800	2,378	41.9	5.5	...	se.	......	......
11:04 a. m...	35.5	1.9	87	ese.	15	6.7	9,807	2,989	37.2	2.9	....	s.	......	......
11:41 a. m...	35.5	1.9	91	ese.	15	6.7	11,084	3,378	32.9	0.5	....	s.	......	......
12:25 p. m...	36.0	2.2	91	ese.	13	5.8	6,951	2,119	41.9	5.5	....	s.	......	......
12:34 p. m...	36.0	2.2	91	ese.	13	5.8	5,512	1,689	41.0	5.0	....	s.	......	....
12:44 p. m...	36.0	2.2	91	ese.	13	5.8	3,880	1,182	35.1	1.7	....	sse.	......	......
1:36 p. m...	36.0	2.2	98	ese.	11	4.9	1,725	526	36.0	2.2	98	ese.	11	4.9
Nov. 21, 1907.														
1:17 p. m...	46.0	7.8	100	se.	9	4.0	1,725	526	46.0	7.8	100	se.	9	4.0
1:40 p. m...	46.0	7.8	100	se.	8	3.6	2,326	709	44.2	6.8	....	ssw.	......	......
1:48 p. m...	40.6	7.8	100	se.	9	4.0	3,314	1,010	51.1	10.6	....	ssw.	......	......
1:58 p. m...	40.6	7.8	100	se.	9	4.0	4,501	1,372	51.1	10.6	....	sw.	......	......
2:13 p. m...	40.6	7.8	100	se.	9	4.0	2,844	867	54.9	12.7	...	s.	......	......
2:28 p. m.	46.2	7.9	100	se.	9	4.0	1,725	526	46.2	7.9	100	se.	9	4.0
2d flight.														
3:50 p. m. .	46.3	7.9	100	se.	10	4.5	1,725	526	46.3	7.9	100	se.	10	4.5
3:07 p. m...	46.3	7.9	100	se.	10	4.5	4,484	1,367	49.8	9.9	....	sw.	......	......
4:05 p. m. .	46.6	8.1	100	se.	10	4.5	1,725	526	46.6	8.1	100	se.	10	4.5

November 20, 1907.—Four kites having a total lifting surface of 272 sq. ft. (25.2 sq. m.) were used. Wire out, 20,000 ft. (6,096 m.); at maximum altitude, 17,400 ft. (5,304 m.).

At the beginning of the flight the sky was partly covered with Ci. and A.-Cu. from the west. By 9 a. m. the Ci. had spread nearly over the sky, but by 10 a. m. they had been replaced by A.-St. from the west and St. from the south-southeast. A.-St. sheet covered the sky at 11:30 a. m., moving from the east-southeast, but by noon the direction had changed to the south-southeast. Light rain began at 12:21 p. m., was succeeded by sleet at 12:42 p. m., and this in turn gave place to rain at 12:55 p. m. St. clouds were passing beneath the kites from 9:51 until 10 a. m. At 12:34 p. m. the lower clouds were thought to be about 650 ft. from the ground.

High pressure was central over the St. Lawrence Valley and extended down along the coast nearly to Florida, while an active low was centered over Arkansas.

November 21, 1907.—First flight: One kite with a lifting surface of 68 sq. ft. (6.3 sq. m.) was used. Wire out, 4,000 ft. (1,219 m.) at the maximum altitude. Dense fog prevailed during the entire flight.

Second flight: One kite having a lifting surface of 68 sq. ft. (6.3 sq. m.) was used. Wire out, 6,000 ft. (1,829 m.); at the maximum altitude, 4,000 ft. (1,219 m.). Fog was dense thruout the flight.

At 8 a. m. an area of high pressure was moving off the New England coast, and an extensive low was central east of Lake Superior.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Nov. 22, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:20 a. m...	43.5	6.4	100	nw.	9	4.0	1,725	526	43.5	6.4	100	nw.	9	4.0
8:20 a. m...	48.8	6.6	100	nw.	7	3.1	2,754	845	52.9	11.6	....	wnw.	......	......
8:42 a. m...	44.0	6.7	100	nw.	7	3.1	3,163	955	47.7	8.7	....	wnw.	......	......
2:06 p. m...	45.0	7.2	100	nw.	5	2.2	2,487	758	42.6	5.9	....	n.	......	......
2:54 p. m...	45.0	7.2	96	nw.	5	2.2	3,272	997	41.0	5.0	....	n.	......	......
3:03 p. m...	45.0	7.2	96	nw.	5	2.2	2,426	740	45.9	7.7	....	nw.	......	......
3:19 p. m...	45.0	7.2	96	nw.	5	2.2	1,725	526	45.0	7.2	96	nw.	5	2.2
Nov. 23, 1907.														
7:40 a. m...	41.0	5.0	97	nne.	10	4.5	1,725	526	41.0	5.0	97	nne.	10	4.5
7:48 a. m...	41.8	5.4	83	nne.	9	4.0	2,871	875	39.0	3.9	....	ne.	......	......
8:25 a. m...	41.6	5.8	90	nne.	6	2.7	3,691	1,125	36.9	2.7	....	e.	......	......
9:04 a. m...	41.8	5.4	86	nne.	6	2.7	5,061	1,543	36.3	2.4	....	e.	......	......
9:24 a. m...	41.0	5.0	94	nne.	6	2.7	5,401	1,646	35.8	2.1	....	e.	......	......
10:00 a. m...	40.8	4.9	92	nne.	10	4.5	5,719	1,743	33.4	0.8	....	ene.	......	......
11:12 a. m...	37.8	4.3	100	wnw.	10	4.5	6,710	2,045	24.3	− 4.3	....	ese.	......	......
11:36 a. m...	39.5	4.2	96	wnw.	10	4.5	7,460	2,274	31.1	− 0.5	....	ese.	......	......
11:50 a. m...	39.5	4.2	94	wnw.	10	4.5	3,716	1,133	30.9	− 0.6	....	ene.	......	......
12:02 p. m...	39.4	4.1	94	wnw.	10	4.5	2,728	831	34.0	1.1	....	ene.	......	......
12:07 p. m...	39.3	4.1	96	wnw.	10	4.5	1,725	526	39.3	4.1	96	wnw.	10	4.5

November 22, 1907.—Two kites having a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 3,750 ft. (1,143 m.); at maximum altitude, 3,000 ft. (914 m.).

Fog was dense until 9:45 a. m., light until 10 a. m., dense until 11:35 a. m., light until 11:42 a. m., dense until 1:42 p. m., and light thereafter. Light rain began at 3:19 p. m. When the fog lifted at intervals the sky was seen to be covered with St.-Cu., later with St., moving from the southeast.

A belt of high pressure extended from California to Pennsylvania and low pressure areas were central over the Gulf of Mexico, the Gulf of St. Lawrence, and in the Canadian northwest.

November 23, 1907.—Four kites having a total lifting surface of 272 sq. ft. (25.2 sq. m.) were used. Wire out, 13,000 ft. (3,962 m.); at the maximum altitude, 9,000 ft. (2,743 m.).

Light rain fell from 8:09 to 8:17, from 9:40 to 9:45, and after 10:20 a. m. Sleet was mixed with the rain between 10:30 and 11:15 a. m. About 10 a. m. the kites were obscured at intervals by patches of cloud.

High pressure was central over the Lakes and low pressure over Alabama.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Nov. 25, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:36 a. m...	28.8	—1.8	89	nw.	25	11.2	1,725	526	28.8	— 1.8	89	nw.	25	11.2
7:50 a. m ..	29.0	—1.7	87	nw.	25	11.2	2,831	863	27.9	— 2.3	....	nw.	......	......
7:58 a. m...	29.0	—1.7	87	nw.	25	11.2	3,607	1,099	28.9	— 1.7	....	nw.	......	......
8:10 a. m...	29.0	—1.7	87	nw.	25	11.2	4,465	1,361	31.3	— 0.4	....	nnw	......	......
8:28 a. m...	30.0	—1.1	84	nw.	25	11.2	6,193	1,888	34.3	1.3	....	nw.	......	......
8:38 a. m...	30.0	—1.1	84	nw.	25	11.2	6,437	1,962	35.2	1.8	....	nw.	......	......
9:57 a. m...	33.4	0.8	82	nw.	29	13.0	7,348	2,240	39.6	4.2	....	wnw.	......	......
10:17 a. m...	34.5	1.4	78	nw.	28	12.5	10,847	3,306	30.9	— 0.6	....	wnw.	......	......
10:47 a. m...	35.0	1.7	81	nw.	28	12.5	11,920	3,633	22.1	— 5.5	....	w.	......	......
11:31 a. m...	36.0	2.2	74	nw.	27	12.1	8,535	2,602	40.6	4.8	....	w.	......	......
11:39 a. m...	36.0	2.2	74	nw.	27	12.1	5,092	1,552	34.0	1.1	....	nw.	......	......
11:50 a. m...	36.0	2.2	74	nw.	27	12.1	4,134	1,260	34.9	1.6	....	nw.	......	......
12:01 p. m...	37.0	2.8	68	nw.	38	17.0	3,607	1,099	28.4	— 2.0	...	nw.	......	......
12:35 p. m...	37.6	3.1	69	nw.	42	18.8	1,725	526	37.6	3.1	69	nw.	42	18.8
Nov. 26, 1907.														
7:43 a. m...	37.5	3.1	70	w.	20	8.9	1,725	526	37.5	3.1	70	w.	20	8.9
7:49 a. m...	37.5	3.1	66	w.	20	8.9	2,829	893	35.6	2.0	....	w.	......	......
7:59 a. m...	37.8	3.2	66	w.	20	8.9	3,823	1,165	31.5	— 0.3	....	wnw.	......	......
8:18 a. m...	37.9	3.3	70	w.	26	11.6	4,722	1,439	26.8	— 2.9	....	wnw.	.....	......
8:24 a. m...	37.5	3.1	70	w.	30	13.4	5,262	1,604	24.6	— 4.1	....	wnw.	......	......
8:52 a. m ..	39.1	3.9	61	w.	32	14.3	4,356	1,328	28.0	— 2.2	....	wnw.	......	......
9:12 a. m...	40.0	4.4	56	wnw.	35	15.6	1,725	526	40.0	4.4	56	wnw.	35	15.6
Nov. 27, 1907.														
9:00 a. m...	32.3	0.2	59	nw.	19	8.5	1,725	526	32.3	0.2	59	nw.	19	8.5
9:09 a. m..	33.0	0.6	56	nw.	19	8.5	2,923	891	30.7	— 0.7	....	nw.	......	......
9:15 a. m...	33.2	0.7	56	nw.	18	8.0	3,730	1,137	28.8	— 1.8	....	nw.	......	......
10:49 a. m...	38.3	3.5	49	nw.	13	5.8	5,093	1,552	25.3	— 3.7	....	nw.	......	......
11:34 a. m...	40.7	4.8	41	nw.	9	4.0	6,010	1,832	22.5	— 5.3	.. .	nw.	......	......
12:58 p. m...	44.0	6.7	37	sw.	7	3.1	6,906	2,105	22.1	— 5.5	....	nw.	......	......
1:06 p. m...	44.0	6.7	37	sw.	7	3.1	5,764	1,757	25.0	— 3.9	....	nw.	......	......
1:17 p. m...	44.0	6.7	37	sw.	7	3.1	5,477	1,669	25.2	— 3.8	....	wnw.	......	......
1:30 p. m...	44.4	6.9	37	sw.	7	3.1	3,478	1,059	34.5	1.4	....	w.	......	......
1:45 p. m...	44.0	6.7	37	sw.	7	3.1	1,725	526	44.0	6.7	37	sw.	7	3.1

November 25, 1905.—Two kites having a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 20,000 ft. (6,096 m.); at the maximum altitude, 18,750 ft. (5,715 m.).

From 1 to 3 tenths of upper clouds, moving from the northwest, were visible during the flight.

Pressure was high over the Gulf of St. Lawrence and over the Gulf States. An area of low pressure was central over Lake Superior and a more active low was centered over Long Island Sound.

November 26, 1907.—One kite with a lifting surface of 68 sq. ft. (6.3 sq. m.) was used. Wire out, 7,100 ft. (2,164 m.) at the maximum altitude.

A few St., moving from the west-northwest at the beginning of the flight, increased to 2 tenths at its close.

Pressure was high over the lower Mississippi Valley, but low over the Lakes and the St. Lawrence Valley.

November 27, 1907.—Two kites having a total lifting surface of 144 sq. ft. (13.1 sq. m.) were used. Wire out, 12,000 ft. (3,658 m.) at the time the kites reached the greatest height.

A few Ci. from the northwest were observed at intervals until about 1:30 p. m., when the sky became partly covered with Ci.

High pressure lay over the South Atlantic and Gulf States, while lows were central over the Gulf of St. Lawrence and over Minnesota, respectively.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Nov. 28, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
8:52 a. m...	46.0	7.8	56	w.	8	3.6	1,725	526	46.0	7.8	56	w.	8	3.6
9:00 a. m...	45.5	7.5	59	w.	15	6.7	2,923	891	43.5	6.4	....	w.	......	......
9:07 a. m...	46.2	7.9	59	w.	10	4.5	3,936	1,200	38.3	3.5	....	w.	......	......
9:23 a. m..	46.5	8.1	56	w.	10	4.5	5,154	1,571	31.5	− 0.3	....	w.	......	......
9:40 a. m...	46.0	7.8	58	w.	9	4.0	6,982	2,128	24.8	− 4.0	....	nw.	......	......
9:48 a. m...	46.5	8.1	56	sw.	9	4.0	7,631	2,326	25.2	− 3.8	....	nw.	......	......
10:07 a. m...	46.8	8.2	56	sw.	9	4.0	5,814	1,772	25.5	− 3.6	....	nw.	......	......
10:30 a. m...	47.0	8.3	58	sw.	9	4.0	1,725	526	47.0	8.3	58	sw.	9	4.0
Nov. 29, 1907.														
7:30 a. m...	30.9	−0.6	55	nw.	9	4.0	1,725	526	30.9	− 0.6	55	nw.	9	4.0
7:54 a. m...	30.6	−0.8	58	nw.	9	4.0	2,890	881	27.5	− 2.5	...	nw.	......	......
8:21 a. m...	31.0	−0.6	57	nw.	6	2.7	4,420	1,347	20.7	− 6.3	....	nnw.	......	......
8:44 a. m...	31.5	−0.3	60	nw.	4	1.8	6,106	1,861	32.7	0.4	....	nw.	.....	......
9:02 a. m...	32.8	0.4	54	nw.	5	2.2	6,350	1,936	34.5	1.4	....	nw.	......	......
9:46 a. m...	33.0	0.6	53	nw.	5	2.2	5,521	1,683	25.0	− 3.9	....	nw.	......	......
10:08 a. m...	33.3	0.7	50	nw.	4	1.8	4,584	1,397	22.1	− 5.5	....	nw.	......	......
11:00 a. m...	35.6	2.0	48	nw.	4	1.8	1,725	526	35.6	2.0	48	nw.	4	1.8
Nov. 30, 1907.														
7:50 a. m ..	30.0	−1.1	61	se.	11	4.9	1,725	526	30.0	− 1.1	61	se.	11	4.9
8:34 a. m...	29.5	−1.4	62	e.	11	4.9	2,670	814	27.3	− 2.6	....	ese.	......	......
9:40 a. m...	33.0	0.6	60	se.	12	5.4	3,371	1,027	27.3	− 2.6	....	se.	......	......
10:02 a. m...	33.6	0.9	57	se.	12	5.4	3,092	943	26.6	− 3.0	....	sse.	......	......
10:20 a. m...	32.8	0.4	59	se.	12	5.4	1,725	526	32.8	0.4	59	se.	12	5.4

November 28, 1907.—Two kites having a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 12,000 ft. (3,658 m.); at the maximum altitude, 11,500 ft. (3,505 m.).

The sky was covered with A.-St. and St.-Cu. from the west until about 10:30 a. m., when Ci.-St., also from the west, succeeded the St.-Cu.

High pressure, central over Nevada, extended over the western part of the country, while centers of low pressure lay over the northern Gulf and over the Lakes.

November 29, 1907.—Two kites having a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 8,800 ft. (2,682 m.); at the maximum altitude, 8,000 ft. (2,438 m.).

During the flight the sky was three-fourths covered with Ci. and A.-Cu. from the west at the beginning of the flight, and Ci. from the west-southwest after about 7:40 a. m.

High pressure covered the region west of the Mississippi. Low pressure was central over Florida and the Gulf of St. Lawrence.

November 30, 1907.—Four kites with a total lifting surface of 278 sq. ft. (25.7 sq. m.) were used. Wire out, 7,500 ft. (2,286 m.), at the time the maximum altitude was reached.

Ci., moving from the southwest, were observed during the earlier part of the flight, and again near its close.

Areas of high pressure, central north of the lower Lakes and over Utah, were separated by a low that occupied the middle Mississippi Valley. Pressure was also low, relatively, off the south Atlantic coast.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 2, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:05 p. m...	27.5	−2.5	60	nw.	23	10.8	1,725	526	27.5	− 2.5	60	nw.	23	10.3
1:23 p. m...	28.0	−2.2	66	nw.	23	10.8	3,037	926	20.1	− 6.6	....	nw.	......	......
1:34 p. m...	28.3	−2.1	65	nw.	23	10.8	4,207	1,282	13.1	−10.5	....	wnw.	......	......
1:53 p. m...	27.0	−2.8	65	nw.	23	10.8	5,459	1,664	7.5	−13.6	....	wnw.	......	......
2:12 p. m..	27.0	−2.8	53	nw.	23	10.8	6,552	1,997	4.8	−15.3	....	nw.	......	......
2:39 p. m...	27.0	−2.8	53	nw.	23	10.8	7,209	2,197	4.6	−15.2	....	nw.	......	......
2:49 p. m...	26.6	−3.0	52	nw.	23	10.3	7,484	2,281	9.0	−12.8	....	nw.	......	......
3:14 p. m...	26.7	−2.9	55	nw.	23	10.8	10,134	3,089	7.5	−13.6	....	nw.	......	......
3:31 p. m...	26.4	−3.1	58	nw.	23	10.8	11,871	3,618	2.8	−16.2	....	nw.	......	......
3:48 p. m...	26.0	−3.3	58	nw.	23	10.3	10,177	3,102	3.2	−16.0	....	nw.	......	......
4:02 p. m...	26.0	−3.3	58	nnw.	20	8.9	8,641	2,634	8.2	−18.2	...	nw.	......	......
4:28 p. m...	25.2	−3.8	68	nnw.	16	7.2	7,895	2,406	7.9	−13.9	....	nw.	......	......
4:48 p. m...	24.3	−4.3	76	nnw.	16	7.2	5,690	1,734	10.2	−12.1	....	nw.	......	......
4:58 p. m...	24.0	−4.4	80	nnw.	16	7.2	4,485	1,367	12.6	−10.8	....	nw.	......	......
5:06 p. m...	24.0	−4.4	80	nnw.	18	8.0	3,910	1,192	14.5	− 9.7	....	wnw.	......	......
5:12 p. m...	24.0	−4.4	80	nnw.	18	8.0	2,785	849	18.3	− 7.6	....	nw.	......	......
5:30 p. m...	24.0	−4.4	87	nnw.	20	8.9	1,725	526	24.0	− 4.4	87	nnw.	20	8.9
Dec. 3, 1907.														
7:37 a. m...	20.2	−6.6	78	se.	12	5.4	1,725	526	20.2	− 6.6	78	se.	12	5.4
7:58 a. m...	20.0	−6.7	79	se.	12	5.4	2,890	881	19.2	− 7.1	....	s.	......	......
8:10 a. m...	20.0	−6.7	79	se.	16	7.2	3,786	1,154	19.2	− 7.1	....	s.	......	......
8:25 a. m...	20.4	−6.4	77	se.	16	7.2	5,476	1,669	15.4	− 9.2	....	sw.	......	......
8:51 a. m...	20.7	−6.3	77	se.	16	7.2	6,384	1,946	12.4	−10.9	....	sw.	......	......
9:27 a. m...	21.0	−6.1	78	se.	18	8.0	7,803	2,378	12.4	−10.9	....	sw.	......	......
10:15 a. m...	21.0	−6.1	84	se.	14	6.3	1,725	526	21.0	− 6.1	84	se.	14	6.3
2d flight.														
5:58 p. m...	23.0	−5.0	100	nnw.	10	4.5	1,725	526	23.0	− 5.0	100	nnw.	10	4.5
6:32 p. m...	22.6	−5.2	100	nnw.	11	4.9	2,868	874	21.2	− 6.0	....	nnw.	......	......
6:51 p. m...	22.5	−5.3	100	n.	12	5.4	4,417	1,346	17.1	− 8.3	...	n.	......	......
7:13 p. m...	22.4	−5.3	100	n.	12	5.4	5,159	1,572	14.5	− 9.7	....	n.	......	......
7:26 p. m.	22.3	−5.3	100	n.	12	5.4	3,499	1,066	22.5	− 5.3	....	n.	......	......
7:29 p. m...	22.3	−5.3	100	n.	12	5.4	2,730	832	21.2	− 6.0	....	n.	......	......
7:33 p. m...	22.8	−5.1	100	n.	14	6.3	1,725	526	22.8	− 5.1	100	n.	14	6.3

December 2, 1907.—Two kites having a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 20,000 ft. (6,096 m.) at the maximum altitude.

A few Ci. clouds were moving from the west-northwest until about 3 p. m., when the direction changed to west and the amount increased to 7/10 or 8/10, decreasing to 3/10 or less after 4 p. m.

A low was central east of Maine and a secondary low was over Arkansas. Pressure was high over southern Alabama and higher over the Rocky Mountain region.

December 3, 1907.—First flight: Two kites with a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 15,000 ft. (4,572 m.) at the maximum altitude.

The sky was covered with St. clouds moving from the west. The leading kite disappeared into the clouds at 8:55 a. m. Snow began at 10.25 a. m.

Second flight: One kite with a lifting surface of 74 sq. ft. (6.8 sq. m.) was used. Wire out, 7,000 ft. (2,134 m.); at maximum altitude, 6,900 ft. (2,103 m.).

Dense fog, diminishing at intervals, prevailed, and snow fell from 4:45 p. m. until 6 p. m., and again during the latter part of the flight.

At 8 a. m. relatively low pressure was central over West Virginia, while pressure was high off the Atlantic coast and over the western half of the United States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 4, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:43 a. m...	20.0	—6.7	100	nnw.	7	3.1	1,725	526	20.0	— 6.7	100	nnw.	7	3.1
8:13 a. m...	20.8	—6.2	100	nnw.	7	3.1	2,368	722	18.9	— 7.3	....	n.	.....	......
9:10 a. m...	21.4	—5.9	100	nnw.	10	4.5	2,896	883	18.1	— 7.7	...	n.	.....	......
9:44 a. m...	21.8	—5.7	100	nnw.	9	4.0	1,725	526	21.8	— 5.7	100	nnw.	9	4.0
2d flight.														
1:29 p. m...	22.4	—5.3	100	nnw.	10	4.5	1,725	526	22.4	— 5.3	100	nnw.	10	4.5
1:55 p. m...	22.5	—5.3	100	nnw.	14	6.3	2,715	828	18.0	— 7.8	....	n.	......	.....
2:26 p. m...	22.1	—5.5	100	nnw.	15	6.7	3,756	1,145	16.0	— 8.9	....	n.	......	......
3:05 p. m...	21.5	—5.8	100	nnw.	15	6.7	5,597	1,706	10.8	—11.8	....	n.	......	......
3:45 p. m...	21.0	—6.1	100	nnw.	16	7.2	6,116	1,863	8.4	—13.1	..	n.	.....	......
4:05 p. m...	21.0	—6.1	100	nnw.	18	8.0	6,715	2,047	5.4	—14.8	....	nne.	......	......
4:30 p. m...	21.0	—6.1	100	nnw.	18	8.0	4,687	1,429	10.8	—11.8	....	n.	......	......
4:45 p. m...	21.0	—6.1	100	nnw.	18	8.0	3,265	995	14.4	— 9.8	....	n.	......	......
4:55 p. m...	21.0	—6.1	100	nnw.	18	8.0	2,646	806	16.2	— 8.8	...	n.	......	......
5:05 p. m...	21.0	—6.1	100	nnw.	18	8.0	1,725	526	21.0	— 6.1	100	nnw.	18	8.0
Dec. 5, 1907.														
4:00 p. m.	23.8	—4.6	63	nw.	38	17.0	1,725	526	23.8	— 4.6	63	nw.	38	17.0
4:13 p. m...	23.6	—4.7	60	nw.	38	17.0	3,270	997	18.7	— 7.4	...	wnw.	......	......
4:20 p. m...	23.6	—4.7	60	nw.	38	17.0	3,637	1,109	28.2	— 2.1	....	wnw.	......	......
4:42 p. m...	22.9	—5.1	60	nw.	37	16.5	3,856	1,175	30.7	— 0.7	....	nw.	......	......
4:48 p. m...	22.6	—5.2	68	nw.	36	16.1	4,280	1,305	27.7	— 2.4	....	nw.	......	......
5:07 p. m...	22.3	—5.4	68	nw.	32	14.3	6,327	1,928	24.1	— 4.4	....	nw.	......	......
5:28 p. m...	22.5	—5.3	67	nw.	24	10.7	7,775	2,370	18.1	— 7.7	....	nw.	......	......
5:51 p. m...	21.2	—6.0	72	nw.	31	13.9	6,239	1,902	23.2	— 4.9	....	nw.	......	......
6:02 p. m..	21.2	—6.0	71	nw.	30	13.4	5,545	1,690	25.7	— 3.5	....	nw.	......	......
6:10 p. m...	21.0	—6.1	71	wnw.	30	13.4	4,195	1,279	26.1	— 3.3	....	wnw.	......	......
6:19 p. m...	21.0	—6.1	71	wnw.	29	13.0	3,264	995	18.0	— 7.8	....	wnw.	.....	......
6:33 p. m...	21.0	—6.1	71	wnw.	22	9.8	1,725	526	21.0	— 6.1	71	wnw.	22	9.8

December 4, 1907.—First flight: Two kites having a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out, 3,000 ft. (914 m.) at the maximum altitude.

Light snow fell thruout the flight and dense fog prevailed.

High pressure, central over Iowa, covered the interior of the country, and low pressure was central off Nantucket and over the South Carolina coast.

Second flight: Three kites having a total lifting surface of 210 sq. ft. (19.4 sq. m.) were used. Wire out, 13,500 ft. (4,115 m.); at the maximum altitude, 11,430 ft. (3,484 m.).

Light fog prevailed and light snow continued thruout the flight.

December 5, 1907.—Four kites having a total lifting surface of 159 sq. ft. (14.6 sq. m.) were used. Wire out, 14,000 ft. (4,267 m.); at the maximum altitude, 13,500 ft. (4,115 m.).

The sky was partly covered with Ci. clouds moving from the northwest. A few A.-St., also from the northwest, were observed about 5:30 p. m.

Pressure was high over the Ohio and the lower Mississippi valleys and low off Nantucket.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 6, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
8:00 a. m...	26.0	−3.3	40	w.	16	7.2	1,725	526	26.0	− 3.3	40	w.	16	7.2
8:22 a. m...	27.4	−2.6	42	w.	12	5.4	3,035	925	23.7	− 4.6	....	wnw.	......	......
8:33 a. m...	28.0	−2.2	44	w.	12	5.4	3,843	1,171	21.6	− 5.8	....	nw.	......	......
8:48 a. m..	28.6	−1.9	40	w.	12	5.4	4,589	1,399	29.8	− 1.2	....	nnw.	......	......
8:59 a. m...	29.0	−1.7	34	w.	12	5.4	5,566	1,697	32.4	0.2	....	nnw.	......	......
9:16 a. m...	28.4	−2.0	38	w.	13	5.8	5,938	1,810	33.1	0.6	....	nnw.	......	......
10:02 a. m...	31.0	−0.6	29	w.	13	5.8	7,566	2,306	28.8	− 1.8	....	nnw.	......	......
10:20 a. m...	31.4	−0.3	29	w.	13	5.8	10,234	3,119	25.5	− 3.6	....	nnw.	......	......
11:04 a. m...	32.5	0.3	28	w.	13	5.8	8,809	2,685	31.6	− 0.3	....	nnw.	......	......
11:24 a. m...	33.0	0.6	31	w.	12	5.4	7,129	2,173	32.5	0.3	....	nnw.	......	......
11:54 a. m...	34.0	1.1	31	w.	10	4.5	5,594	1,705	38.3	3.5	....	nnw.	......	......
12:06 p. m...	34.6	1.4	32	w.	9	4.0	4,143	1,263	32.4	0.2	....	nw.	......	......
12:19 p. m...	35.0	1.7	34	wsw.	9	4.0	3,343	1,019	26.1	− 3.3	....	wnw.	......	......
12:30 p. m...	35.2	1.8	35	wsw.	8	3.6	1,725	526	35.2	1.8	35	wsw.	8	3.6
Dec. 7, 1907.														
6:51 p. m...	46.0	7.8	43	s.	9	4.0	1,725	526	46.0	7.8	43	s.	9	4.0
7:40 p. m...	45.7	7.6	43	sw.	4	1.8	2,181	665	50.0	10.0	....	s.	......	......
9:19 p. m...	47.3	8.5	47	w.	5	2.2	1,725	526	47.3	8.5	47	w.	5	2.2
Dec. 9, 1907.														
10:38 a. m...	40.7	4.8	100	se.	12	5.4	1,725	526	40.7	4.8	100	se.	12	5.4
10:48 a. m...	41.0	5.0	100	se.	10	4.5	2,844	867	49.1	9.5	....	s.	......	......
10:58 a. m...	41.4	5.2	100	se.	10	4.5	3,567	1,087	47.3	8.5	....	s.	......	......
11:08 a. m...	40.5	4.7	100	se.	11	4.9	4,229	1,289	44.6	7.0	....	s.	......	......
11:28 a. m...	40.2	4.6	100	se.	12	5.4	3,563	1,086	47.3	8.5	....	s.	......	......
11:44 a. m...	40.0	4.4	100	se.	12	5.4	3,415	1,041	46.6	8.1	....	s.	......	......
11:45 a. m...	40.0	4.4	100	se.	12	5.4	1,725	526	40.0	4.4	100	se.	12	5.4

December 6, 1907.—Two kites having a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out, 20,100 ft. (6,126 m.) at the maximum altitude.

The sky was clear.

Pressure was high over the Eastern and Southeastern States, with centers over West Virginia and Georgia. The barometer was low over Nova Scotia and the Canadian northwest, and there was a slight depression over northern Texas.

December 7, 1907.—Two kites with a total lifting surface of 112 sq. ft. (10.3 sq.m.) were used. Wire out, 2,000 ft. (614 m.) at maximum altitude.

A.-St. and St.-Cu. clouds from the west partly covered the sky.

At 8 a. m. high pressure covered the South Atlantic States, with a center over western Virginia; and low pressure was central over the Gulf of St. Lawrence.

December 9, 1907.—One kite having a lifting surface of 44 sq. ft. (4.1 sq. m.) was used. Wire out, 8,000 ft. (2,438 m.) at maximum altitude.

Light rain and dense fog prevailed.

An active low occupied the Mississippi Valley, with its center over Arkansas. Pressure was high over the north Atlantic coast and over the northern Rocky Mountain plateau and slope. At 8 a. m. rain was falling over practically the whole Mississippi Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 10, 1907	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
3:55 p. m.	50.1	10.1	95	ssw.	6	2.7	1,725	526	50.1	10.1	95	ssw.	6	2.7
3:58 p. m.	49.8	9.9	96	......	6	2.7	2,400	732	48.9	9.4	....	......	......	......
4:04 p. m.	49.6	9.8	97	s.	5	2.2	2,961	902	46.9	8.3	....	sw.	......	......
4:12 p. m.	49.3	9.6	97	s.	6	2.7	3,978	1,212	41.5	5.3	....	sw.	......	......
4:21 p. m.	49.0	9.4	95	s.	6	2.7	5,138	1,566	36.7	2.6	....	wsw.	......	......
4:36 p. m.	48.8	9.3	98	s.	7	3.1	5,725	1,745	32.7	0.4	....	w.	......	......
4:54 p. m.	46.5	8.1	100	sw.	19	8.5	7,395	2,254	25.5	− 3.6	....	w.	......	......
4:58 p. m.	46.0	7.8	100	w.	32	14.3	4,905	1,495	38.1	3.4	....	w.	......	......
6:00 p. m.	37.0	2.8	95	nw.	38	17.0	1,725	526	37.0	2.8	95	nw.	38	17.0
Dec. 11, 1907														
11:30 a. m.	30.5	−0.8	62	nw.	26	11.6	1,725	526	30.5	− 0.8	62	nw.	26	11.6
12:21 p. m.	31.0	−0.6	64	nw.	26	11.6	3,133	955	24.8	− 4.0	....	wnw.	......	......
12:40 p. m.	31.7	−0.2	57	nw.	26	11.6	3,715	1,132	21.2	− 6.0	....	wnw.	......	......
12:50 p. m.	32.0	0.0	63	nw.	26	11.6	5,448	1,660	15.8	− 9.0	....	nw.	......	......
1:00 p. m.	31.7	−0.2	53	nw.	25	11.2	6,384	1,946	19.6	− 6.9	....	nw.	......	......
1:42 p. m.	30.6	−0.8	58	nw.	25	11.2	7,317	2,230	8.6	−13.0	....	nw.	......	......
1:55 p. m.	30.8	−0.9	61	nw.	25	11.2	4,820	1,469	14.4	−10.0	....	w.	......	......
3:00 p. m.	29.0	−1.7	63	nw.	24	10.7	6,092	1,859	14.5	− 9.7	....	w.	......	......
3:30 p. m.	28.8	−1.8	67	nw.	24	10.7	3,080	939	19.0	− 7.2	....	nw.	......	......
4:00 p. m.	28.1	−2.2	73	nw.	25	11.2	1,725	526	28.1	− 2.2	73	nw.	25	11.2

December 10, 1907.—Two kites with a total lifting surface of 136 sq. ft. (13.1 sq. m.) were used. Wire out, 10,000 ft. (3,048 m.); at maximum altitude, 8,500 ft. (2,591 m.).

Light fog prevailed at the beginning of the flight, and the sky was partly covered with St.-Cu. from the southwest. Dense fog from the southwest set in at 4:47 p. m. and a thunderstorm, also from the southwest, past over the station; rain fell from 4:52 to 5:25 p. m., and sharp lightning, accompanied by thunder, was seen at 5:06 p. m. One discharge of lightning drew the temper from several thousand feet of wire nearest the head kite, coloring it a dark blue. The twisted splices were not discolored, indicating that they had sufficient conductivity to accommodate the discharge.

At 8 a. m. high pressure lay over the western part of the country, and low pressure prevailed east of the Mississippi. In the last twenty-four hours the storm center moved from Arkansas to Lake Ontario, causing snow in northern, and rain and thunderstorms in southern districts east of the Mississippi.

December 11, 1907.—Three kites having a total lifting surface of 191 sq. ft. (17.6 sq. m.) were used. Wire out, 15,000 ft. (4,472 m,); at maximum altitude, 10,000 ft. (3,048 m.).

The sky was partly covered until about 1:30 p. m., and thereafter nearly covered with St.-Cu. from the west-northwest. Small amounts of Ci. and of Ci.-Cu. from the west were observed at intervals. The leading kite was in the clouds at 2:03 and at intervals until 2:44 p. m.

At 8 a. m. a well developed low was central over New England. Snow fell east of the Lakes and southward to Virginia. Moderately high pressure occupied the Mississippi Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 12, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:30 p. m...	27.2	—2.7	62	nw.	24	10.7	1,725	526	27.2	— 2.7	62	nw.	24	10.7
1:56 p. m...	28.0	—2.2	66	nw.	24	10.7	2,857	871	18.7	— 7.4	....	wnw.	......	......
2:04 p. m...	28.0	—2.2	66	nw.	24	10.7	3,962	1,208	13.6	—10.2	....	wnw.	......	......
2:21 p. m...	28.0	—2.2	55	nw.	23	10.3	4,646	1,416	11.8	—11.2	....	wnw.	......	......
2:29 p. m...	28.0	—2.2	57	nw.	24	10.7	3,823	1,165	14.4	— 9.8	....	wnw.	......	......
2:40 p. m...	28.0	—2.2	59	nw.	23	10.3	1,725	526	28.0	— 2.2	59	nw.	23	10.3
2d flight.														
2:52 p. m...	27.5	—2.5	65	nw.	23	10.3	1,725	526	27.5	— 2.5	65	nw.	23	10.3
3:07 p. m...	27.2	—2.7	65	nw.	31	13.9	3,524	1,074	18.0	— 7.8	....	nw.	......	......
3:15 p. m...	27.2	—2.7	65	nw.	31	13.9	4,205	1,282	25.2	— 3.8	....	nw.	......	......
3:38 p. m...	26.7	—2.9	65	nw.	29	13.0	5,084	1,550	25.7	— 3.5	....	nw.	......	......
3:50 p. m...	26.8	—2.9	65	nw.	28	12.5	7,530	2,295	19.4	— 7.0	....	nw.	......	......
4:16 p. m...	26.0	—3.3	59	nw.	21	9.4	8,565	2,611	17.6	— 8.0	....	nw.	......	......
4:27 p. m...	25.5	—3.6	64	nw.	21	9.4	7,365	2,245	19.6	— 6.9	....	nw.	......	......
4:35 p. m...	25.2	—3.8	68	nw.	21	9.4	5,815	1,772	23.4	— 4.8	....	nw.	......	......
4:44 p. m...	25.0	—3.9	69	nw.	21	9.4	5,097	1,554	23.4	— 4.8	....	nw.	......	......
5:20 p. m...	24.0	—4.4	66	nw.	25	11.2	3,866	1,178	16.0	— 8.9	....	nw.	......	......
5:36 p. m...	23.7	—4.6	59	nw.	25	11.2	2,767	843	19.2	— 7.1	....	nw.	......	......
5:54 p. m...	23.4	—4.8	65	nw.	25	11.2	1,725	526	23.4	— 4.8	65	nw.	25	11.2
Dec. 13, 1907.														
4:23 p. m...	25.0	—3.9	78	se.	18	8.0	1,725	526	25.0	— 3.9	78	se.	18	8.0
4:30 p. m...	24.7	—4.1	65	se.	18	8.0	2,717	828	37.4	3.0	....	sse.	....	......
4:41 p. m...	24.7	—4.1	68	se.	18	8.0	3,041	927	38.1	3.4	....	sse.	......	......
5:09 p. m...	24.7	—4.1	71	se.	12	5.4	3,856	1,175	38.3	3.5	....	s.	......	......
5:19 p. m...	24.4	—4.2	71	se.	12	5.4	3,472	1,058	35.6	2.0	....	s.	......	......
5:40 p. m...	24.5	—4.2	75	se.	12	5.4	1,725	526	24.5	— 4.2	75	se.	12	5.4
Dec. 14, 1907.														
9:55 a. m...	28.0	—2.2	100	e.	10	4.5	1,725	526	28.0	— 2.2	100	e.	10	4.5
10:07 a. m...	28.0	—2.2	100	e.	19	8.5	3,628	1,106	22.8	— 5.1	....	ese.	......	......
10:12 a. m...	28.0	—2.2	100	e.	19	8.5	4,345	1,324	30.0	— 1.1	....	ese.	......	......
10:28 a. m...	28.8	— 1.8	100	e.	19	8.5	1,725	526	28.8	— 1.8	100	e.	19	8.5

December 12, 1907.—One kite having a lifting surface of 68 sq. ft. (6.3 sq. m.) was used. Wire out, 5,000 ft. (1,524 m.); at the maximum altitude, 4,650 ft. (1,472 m.).

A few St.-Cu. moving from the north-northwest were seen during the flight.

At 8 a. m. pressure was low over Nova Scotia and over northern Texas, while high pressure, central over Ohio, extended from the Lakes to Florida.

Second flight: Two kites with a total lifting surface of 123 sq. ft. (11.3 sq. m.) were used. Wire out, 15,000 ft. (4,572 m.) at the maximum altitude.

A few St.-Cu. from the north-northwest were observed during the flight.

At 8 a. m. an area of high pressure, central over Ohio and extending from the Lakes to Florida, separated low-pressure areas central over Nova Scotia and northern Texas.

December 13, 1907.—Two kites having a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire used, 5,000 ft. (1,524 m.); at maximum altitude, 4,500 ft. (1,372 m.).

During the flight the sky was covered with St. clouds from the southwest.

At 8 a. m. pressure was high over Pennsylvania and low over Louisiana and Nova Scotia, respectively.

December 14, 1907.—One kite with a lifting surface of 55 sq. ft. (5 sq. m.) was used. Wire out, 8,000 ft. (2,438 m.) at the maximum altitude.

At the beginning of the flight the sky was covered with St. clouds from the east. Dense fog, also from the east, prevailed after 10 a. m. Rain ended just before the flight and began again at 10:25 a. m; amount for the day, 1.74 inches.

An active low was central over southern Indiana, with secondary lows over eastern North Carolina and northern Texas. High pressure occupied the St. Lawrence Valley. At 8 a. m. snow was falling from Missouri northward to the Lakes and eastward to the Atlantic.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 16, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
10:29 a. m...	30.5	—0.8	68	wnw.	25	11.2	1,725	526	30.5	— 0.8	68	wnw.	25	11.2
10:40 a. m...	30.7	—0.7	72	wnw.	25	11.2	3,530	1,076	20.5	— 6.4	...	nw.	......	......
10:53 a. m...	30.7	—0.7	72	wnw.	25	11.2	4,467	1,361	16.7	— 8.5	....	wnw.	......	.....
11:04 a. m...	30.8	—0.7	72	wnw.	34	15.2	5,224	1,592	14.0	—10.0	....	wnw.	......	......
11:32 a. m...	31.4	—0.3	75	wnw.	34	15.2	2,753	991	24.4	— 4.2	....	wnw.	......	......
12:05 p. m...	32.3	0.2	67	wnw.	31	13.9	1,725	526	32.3	0.2	67	wnw.	31	13.9
Dec. 17, 1907.														
8:18 a. m...	29.8	—1.2	59	w.	10	4.5	1,725	526	29.8	— 1.2	59	w.	10	4.5
8:26 a. m...	29.9	—1.2	59	w.	10	4.5	2,846	867	29.5	— 1.4	....	w.	......	......
8:36 a. m...	30.0	—1.1	59	wnw.	11	4.9	4,204	1,281	21.7	— 5.7	....	wnw.	......	......
8:45 a. m...	30.0	—1.1	62	wnw.	11	4.9	5,422	1,653	17.6	— 8.0	...	wnw.	......	......
8:51 a. m...	30.0	—1.1	62	wnw.	15	6.7	6,062	1,848	15.4	— 9.2	....	wnw.	......	......
10:12 a. m...	31.0	—0.6	63	wnw.	13	5.8	6,180	1,884	15.1	— 9.4	....	wnw.	......	......
10:24 a. m...	31.0	—0.6	63	wnw.	12	5.4	5,278	1,609	17.6	— 8.0	....	wnw.	......	.....
10:33 a. m...	31.3	—0.4	64	w.	12	5.4	4,785	1,458	19.2	— 7.1	....	wnw.	......	......
11:05 a. m...	31.6	—0.2	61	w.	16	7.2	4,329	1,320	20.3	— 6.5	....	wnw.	......	......
11:14 a. m...	31.8	—0.1	62	w.	19	8.5	3,735	1,138	22.3	— 5.4	....	wnw.	......	......
11:21 a. m...	31.8	—0.1	62	w.	16	7.2	3,033	924	24.6	— 4.1	....	wnw.	......	.....
11:26 a. m...	31.8	—0.1	62	w.	15	6.7	2,523	769	26.6	— 3.0	....	wnw.	......	......
11:35 a. m...	32.0	0.0	61	w.	15	6.7	1,725	526	32.0	0.0	61	w.	15	6.7
Dec. 18, 1907.														
6:48 p. m...	28.1	—2.2	100	w.	10	4.5	1,725	526	28.1	— 2.2	100	w.	10	4.5
6:58 p. m...	28.1	—2.2	100	w.	10	4.5	2,573	784	28.9	— 1.7	....	w.	......	......
7:03 p. m...	28.0	—2.2	100	w.	10	4.5	3,309	1,008	26.8	— 2.9	....	w.	......	......
7:12 p. m...	28.0	—2.2	100	w.	10	4.5	4,171	1,271	23.2	— 4.9	....	w.	......	......
7:18 p. m...	28.0	—2.2	100	w.	9	4.0	4,489	1,368	22.3	— 5.4	....	w.	......	......
7:23 p. m...	28.0	—2.2	100	w.	9	4.0	4,096	1,248	23.9	— 4.5	....	w.	......	......
7:32 p. m...	28.2	—2.1	100	w.	10	4.5	2,656	810	29.1	— 1.6	....	w.	......	......
7:35 p. m...	28.3	—2.1	100	w.	10	4.5	1,725	526	28.3	— 2.1	100	w.	10	4.5

December 16, 1907.—Two kites having a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. Wire out, 8,500 ft. (2,591 m.) at the maximum altitude.

During the flight the sky was nearly or wholly covered with St.-Cu. moving from the west-northwest. A few A.-Cu. from the west were observed.

Low pressure was central over Nova Scotia, with a secondary depression north of Lake Ontario. Pressure was high over Louisiana and north of Dakota. Light snow was falling from Kentucky northeastward.

December 17, 1907.—Four kites, with a total lifting surface of 242 sq. ft. (22.4 sq. m.), were used. Wire out, 15,000 ft. (4,572 m.); at the maximum altitude, 13,400 ft. (4,084 m.).

During the flight the sky was overcast, at first with St.-Cu. from the northwest, later with slightly lower St. from the west-northwest. The leading kite entered the St.-Cu. clouds in ascending at an altitude of 5,422 ft. (1,653 m.) and emerged from the St. clouds at the height of 4,785 ft. (1,458 m.) in descending. The kite was heavily coated with a compact formation of frost, extending one-half inch to windward on some of the larger sticks. The wire also was heavily coated for several hundred feet from the kite.

The barometer was high over the Middle and South Atlantic States, and was low over Texas and the St. Lawrence Valley.

December 18, 1907.—One kite was used in the flight; lifting surface, 74 sq. ft. (6.8 sq. m.). Wire out, 5,500 ft. (1,676 m.); at maximum altitude, 4,200 ft. (1,280 m.).

Light fog prevailed at the beginning of the flight, but it soon became dense and so continued until the kites were landed. The wire, especially that near the kite, was heavily coated with frost when reeled in.

At 8 a. m. a moderate depression lay over lower Canada, and a slighter depression extended from Georgia to eastern Kentucky. The barometer was comparatively high off the middle Atlantic coast and over the Rocky Mountain region.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 19, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters	° F.	° C.	%		Miles p. h.	Met's p. s.
11:34 a. m...	26.7	−2.9	62	nw.	30	13.4	1,725	526	26.7	− 2.9	62	nw.	30	13.4
11:47 a. m...	26.0	−3.3	61	nw.	30	13.4	3,765	1,148	18.5	− 7.5	....	nw.	......	......
11:49 a. m...	26.6	−3.0	61	nw.	30	13.4	4,537	1,383	25.3	− 3.7	....	nw.	......	......
12:02 p. m...	26.4	−3.1	64	nw.	30	13.4	6,146	1,873	16.3	− 8.7	....	wnw.	......	......
12:07 p. m...	26.4	−3.1	64	nw.	30	13.4	5,361	1,634	10.9	−11.7	....	wnw.	......	......
12:42 p. m...	26.8	−2.9	64	nw.	28	12.5	8,594	2,620	14.4	− 9.8	....	wnw.	......	......
1:35 p. m...	27.0	−2.8	65	nw.	30	13.4	11,431	3,484	9.3	−12.6	....	wnw.	......	......
2:32 p. m...	27.6	−2.4	65	nw.	20	8.9	10,280	3,134	13.6	−10.2	....	wnw.	......	......
3:17 p. m...	26.8	−2.9	63	nw.	20	8.9	7,624	2,324	23.5	− 4.7	....	wnw.	......	......
3:25 p. m...	26.8	−2.9	63	nw.	19	8.5	6,343	1,933	18.1	− 7.7	....	wnw.	......	......
3:45 p. m...	26.7	−2.9	63	nw.	10	4.5	5,087	1,550	21.7	− 5.7	....	wnw.	......	......
3:54 p. m...	26.5	−3.1	63	nw.	14	6.3	4,568	1,392	23.5	− 4.7	....	wnw.	......	......
3:57 p. m...	26.5	−3.1	63	nw.	14	6.3	3,949	1,204	17.2	− 8.2	....	wnw.	......	......
4:03 p. m...	26.5	−3.1	63	nw.	14	6.3	2,782	848	20.8	− 6.2	....	wnw.	......	......
4:20 p. m...	25.5	−3.6	64	nw.	12	5.4	1,725	526	25.5	− 3.6	64	nw.	12	5.4
Dec. 20, 1907.														
8:03 p. m...	32.0	0.0	50	wnw.	10	4.5	1,725	526	32.0	0.0	50	wnw.	10	4.5
8:09 p. m...	32.0	0.0	50	nw.	10	4.5	3,935	1,199	27.3	− 2.6	....	nw.	......	......
8:28 p. m..	32.0	0.0	50	nw.	16	7.2	3,105	946	35.6	2.0	....	nw.	......	......
8:40 p. m...	32.1	0.1	49	nw.	14	6.3	4,608	1,404	30.2	− 1.0	....	nw.	......	......
8:44 p. m...	31.8	−0.1	52	wnw.	13	5.8	6,580	2,006	23.9	− 4.5	....	wnw.	......	......
8:50 p. m...	31.5	−0.3	54	w.	13	5.8	4,843	1,476	28.4	− 2.0	....	w.	......	......
8:55 p. m...	31.4	−0.3	55	w.	13	5.8	3,834	1,169	24.3	− 4.3	....	w.	......	......
9:00 p. m..	31.4	−0.3	55	w.	13	5.8	2,872	875	28.4	− 2.0	....	w.	......	......
9:14 p. m...	31.4	−0.3	54	wnw.	13	5.8	1,725	526	31.4	− 0.3	54	wnw.	13	5.8

December 19, 1907.—Four kites, having a total lifting surface of 251 sq. ft. (23.2 sq. m.), were used. Wire out, 23,700 ft. (7,223 m.); at the maximum altitude, 21,000 ft. (6,400 m.).

When the flight began the sky was partly covered with St.-Cu. clouds from the northwest. These gradually disappeared, leaving the sky clear during the latter part of the flight.

High pressure covered practically all of the United States, with centers over western Tennessee and Wyoming. Pressure was low north of the Lakes.

December 20, 1907.—Two kites having a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire used, 7,500 ft. (2,286 m.); at the maximum altitude 5,900 ft. (1,789 m.) of wire was out.

St.-Cu. from the west covered the sky during the entire flight.

At 8 a. m. pressure was high over the country, except over Utah and Arizona and in the upper Lake region. The eastern high area was central over Virginia and North Carolina.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 21, 190˙.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Met rs.	° F.	° C.	%		Miles p. h.	Met's p. s.
8:05 a. m...	29.8	–1.5	69	nw.	24	10.7	1,725	526	29.8	– 1.5	69	nw.	24	10.7
8:10 a. m...	29.4	–1.4	77	nw.	24	10.7	8,845	1,172	24.8	– 4.0	....	nw.	......	......
8:14 a. m...	29.4	–1.4	77	nw.	26	11.6	4,212	1,284	32.0	0.0	....	nw.	...	......
8:29 a. m..	29.8	–1.2	77	nw.	25	11.2	5,588	1,703	37.0	2.8	....	nw.	......	......
8:41 a. m...	29.8	–1.2	77	nw.	82	14.8	6,185	1,870	32.9	0.5	....	nw.	......	......
9:22 a. m...	31.0	–0.6	74	nw.	82	14.8	4,263	1,299	38.5	3.6	...	nw.	......	......
9:50 a. m...	82.0	0.0	74	nw.	31	13.9	8,856	1,176	25.7	– 3.5	....	nw.	......	......
9:58 a. m...	82.0	0.0	74	nw.	31	13.9	8,529	1,076	29.3	– 1.5	....	nw.	......	......
10:02 a. m...	32.8	0.2	74	nw.	31	13.9	8,159	963	23.9	– 4.5	....	nw.	......	......
10:34 a. m...	82.0	0.0	69	nw.	30	13.4	1,725	526	82.0	0.0	69	nw.	30	13.4
Dec. 23, 1907.														
9:02 a. m...	48.7	9.8	100	ssw.	14	6.3	1,725	526	48.7	9.8	100	ssw.	14	6.3
9:20 a. m...	50.0	10.0	100	ssw.	16	7.2	3,334	1,016	49.5	9.7	....	ssw.	......	......
9:30 a. m...	50.0	10.0	100	ssw.	14	6.3	4,147	1,264	50.4	10.2	...	ssw.	......	......
9:57 a. m...	50.0	10.0	100	ssw.	16	7.2	6,206	1,892	43.9	6.6	....	sw.	......	......
10:09 a. m...	49.5	9.7	100	ssw.	12	5.4	7,446	2,270	41.7	5.4	....	sw.	......	......
11:06 a. m...	48.8	9.8	100	s.	12	5.4	7,020	2,140	44.6	7.0	...	sw.	......	......
11:57 a. m...	48.0	8.9	100	s.	12	5.4	5,417	1,651	49.8	9.6	....	ssw.	......	......
12:11 p. m...	48.3	9.1	100	se.	13	5.8	3,931	1,198	54.7	12.6	...	ssw.	......	......
1:35 p. m...	47.7	8.7	100	ssw.	12	5.4	1,725	526	47.7	8.7	100	ssw.	12	5.4

December 21, 1907.—Two kites, having a total lifting surface of 136 sq. ft. (12.6 sq. m.), were used. Wire used, 10,000 ft. (3,048 m.), at the maximum altitude.

At the beginning of the flight a few St. clouds were seen moving from the northwest. Long valley clouds then began to form. Some Ci.-Cu. from the west were seen just before 10 a. m., and from that time until the end of the flight the sky was half covered with St.-Cu. from the northwest.

Pressure was low over the Canadian northwest. and over western Texas; elsewhere the barometer was high, with the eastern center over southern Ohio and West Virginia.

December 23, 1907.—Two kites having a total lifting surface of 102 sq. ft. (9.3 sq. m.) were used. The maximum length of wire, 12,500 ft. (3,810 m.), was out at the maximum altitude.

Dense fog prevailed, and light rain fell at intervals.

A low, central over Indiana at 8 a. m., dominated the weather in the eastern part of the United States.

At 8 a. m. rain was falling from Tennessee northward and eastward. High pressure was central over Nevada.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 24, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	M's p. s.
1:30 p. m. .	37.8	3.2	61	wnw.	17	7.6	1,725	526	37.8	3.2	61	wnw.	17	7.6
1:49 p. m. . .	37.8	3.2	61	wnw.	15	6.7	2,604	794	32.5	0.3	....	nw.	......	.....
2:10 p. m. . .	37.4	3.0	61	wnw.	16	7.2	3,651	1,118	28.2	− 2.1	....	wnw.	......	.....
3:19 p. m. . .	37.8	2.8	64	wnw.	15	6.7	1,725	526	37.8	2.8	64	wnw.	15	6.7
3:43 p. m. . .	37.0	2.8	58	wnw.	14	6.3	3,415	1,041	28.4	− 2.0	....	nw.	......	.....
4:08 p. m. .	36.0	2.2	60	wnw.	8	3.6	4,591	1,399	27.9	− 2.3	....	wnw.	......	.....
4:45 p. m. . .	35.5	1.9	68	wnw.	7	3.1	5,813	1,772	24.8	− 4.0	....	wnw.	......	.....
5:27 p. m. . .	34.0	1.1	62	wnw.	7	3.1	8,009	2,441	17.6	− 8.0	....	nw.	......	.....
5:38 p. m. . .	33.2	0.7	61	nw.	7	3.1	6,314	1,925	23.4	− 4.8	....	nw.	......	.....
5:50 p. m. . .	34.0	1.1	60	wnw.	8	3.6	4,264	1,300	32.0	0.0	....	wnw.	......	.....
5:58 p. m. . .	34.0	1.1	60	wnw.	8	3.6	3,490	1,064	30.4	− 0.9	....	wnw.	......	.....
6:36 p. m. . .	34.0	1.1	58	wnw.	11	4.9	1,725	526	34.0	1.1	58	wnw.	11	4.9
Dec. 25, 1907.														
10:02 a. m. . .	37.0	2.8	58	s.	10	4.5	1,725	526	37.0	2.8	58	s.	10	4.5
10:12 a. m. . .	37.0	2.8	58	s.	11	4.9	2,915	888	32.0	0.0	....	sw.	......	.....
10:22 a. m. . .	38.6	3.7	56	s.	8	3.6	4,685	1,428	30.2	− 1.0	....	wsw.	......	.....
10:28 a. m. . .	38.2	3.4	55	s.	10	4.5	5,418	1,650	31.8	− 0.1	....	w.	......	.....
10:35 a. m. . .	38.0	3.3	55	s.	11	4.9	6,375	1,943	27.7	− 2.4	....	w.	......	.....
10:48 a. m. . .	38.7	3.7	54	sse.	11	4.9	7,906	2,410	23.5	− 4.7	....	w.	......	.....
10:59 a. m. . .	38.8	3.8	52	sse.	10	4.5	9,154	2,790	20.8	− 6.2	...	w.	......	.....
11:18 a. m. . .	39.0	3.9	50	sse.	11	4.9	7,990	2,435	23.7	− 4.6	....	w.	......	.....
11:35 a. m. . .	39.6	4.2	51	se.	11	4.9	6,709	2,045	28.9	− 1.7	....	w.	......	.....
11:45 p. m. . .	40.2	4.6	52	se.	11	4.9	5,646	1,721	32.7	0.4	....	w.	......	.....
12:00 m.	40.2	4.6	52	sse.	10	4.5	4,642	1,415	33.6	0.9	....	w.	......	.....
12:03 p. m. . .	39.8	4.3	52	sse.	10	4.5	4,183	1,275	31.6	− 0.2	....	wsw.	......	.....
12:05 p. m. . .	39.5	4.2	52	sse.	10	4.5	3,702	1,128	34.5	1.4	....	sw.	......	.....
12:06 p. m. . .	39.5	4.2	52	sse.	11	4.9	3,186	971	34.9	1.6	....	ssw.	......	...
12:08 p. m. . .	39.5	4.2	52	sse.	11	4.9	2,652	808	36.0	2.2	....	s.	.....	.....
12:13 p. m. . .	39.5	4.2	52	s.	12	5.4	1,725	526	39.5	4.2	52	s.	12	5.4

December 24, 1907.—For the first part of the flight, one kite, with a lifting surface of 55 sq. ft. (5.0 sq. m.), was used. The second flight was made with four kites having a total lifting surface of 248 sq. ft. (22.9 sq. m.). Wire used, 12,500 ft. (3,810 m.), and 10,000 ft. (3,048 m.) was out at the maximum altitude.

St.-Cu. from the west-northwest nearly covered the sky during the first part of the flight. During the latter part they were partly replaced by Ci.-St. from the same direction.

At 8 a. m. pressure was very low (28.7 inches) over the Gulf of St. Lawrence; another center was over Montana. High pressure was central over Texas and California.

December 25, 1907.—Two kites having a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used. Wire out, 15,000 ft. (4,572 m.) at maximum altitude.

The sky was partly covered with Ci. and A.-St. from the west, but the amount rapidly decreased to a few A.-St. from the west after 10:30 a. m.

Low pressure was central over Michigan, and snow was falling thruout the Lake region, while high pressure lay over the South Atlantic States and over the Rocky Mountain slope.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
Dec. 26, 1907.	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*
7:44 a. m...	34.9	1.6	74	nw.	14	6.3	1,725	526	34.9	1.6	74	nw.	14	6.3
8:06 a. m...	35.0	1.7	76	nw.	12	5.4	2,686	819	34.2	1.2	....	nw.	......	......
8:30 a. m...	35.1	1.7	75	nw.	12	5.4	3,577	4,090	36.7	2.6	....	wnw.	......	......
8:48 a. m...	35.3	1.8	72	nw.	15	6.7	4,018	1,225	33.8	1.0	....	wnw.	......	......
9:12 a. m...	35.7	2.1	71	nw.	20	8.9	6,239	1,902	28.6	−1.9	....	wnw.	......	......
9:28 a. m...	35.8	2.1	70	nw.	13	5.8	8,005	2,440	24.4	−4.2	....	nw.	......	......
11:12 a. m...	39.6	4.2	64	nw.	7	3.1	8,861	2,701	25.5	−3.6	....	nw.	......	......
12:05 p. m...	41.8	5.4	62	wnw.	1	0.4	7,390	2,252	30.6	−0.8	...	nw.	......	......
12:15 p. m...	43.0	6.1	62	se.	1	0.4	5,871	1,789	32.4	0.2	....	w.	......	......
12:25 p. m...	44.3	6.8	63	sse.	1	0.4	3,279	1,000	35.6	2.0	....	wsw.	......	......
12:45 p. m...	43.0	6.1	63	se.	2	0.9	1,725	526	43.0	6.1	63	se.	2	0.9
Dec. 27, 1907.														
7:47 a. m...	44.4	6.9	54	sse.	12	5.4	1,725	526	41.4	6.9	54	sse.	12	5.4
8:06 a. m...	44.0	6.7	51	s.	9	4.0	2,983	909	50.7	10.4	...	wsw.	......	......
8:21 a. m...	44.5	6.9	47	wsw.	7	3.1	4,673	1,425	44.6	7.0	....	wsw.	......	......
8:55 a. m...	47.0	8.3	41	wsw.	4	1.8	6,896	2,102	44.6	7.0	....	wsw.	......	......
9:05 a. m...	48.3	9.1	38	w.	6	2.7	8,028	2,447	39.4	4.1	....	wsw.	......	......
9:28 a. m...	49.5	9.7	36	w.	5	2.2	9,957	3,025	32.0	0.0	....	wsw.	......	......
9:41 a. m...	49.8	9.6	36	w.	5	2.2	10,932	3,332	28.2	−2.1	....	wsw.	......	......
10:15 a. m...	50.7	10.4	36	w.	4	1.8	12,500	3,815	23.0	−5.0	....	wsw.	......	......
10:54 a. m...	55.0	12.8	29	ssw.	10	4.5	11,175	3,406	27.9	−2.3	....	wsw.	......	......
11:17 a. m...	55.7	13.2	31	ssw.	11	4.9	10,120	3,085	33.3	0.7	....	wsw.	......	......
11:44 a. m...	54.3	12.4	36	ssw.	12	5.4	7,677	2,340	41.9	5.5	....	wsw.	......	......
12:06 p. m...	53.0	11.7	35	ssw.	12	5.4	5,817	1,773	50.0	10.0	....	w.	......	......
12:14 p. m...	52.8	11.6	35	s.	12	5.4	4,811	1,466	41.9	5.5	....	w.	......	......
12:23 p. m...	52.7	11.5	34	s.	12	5.4	3,226	984	48.4	9.1	....	sw.	......	......
12:30 p. m...	52.6	11.4	34	ssw.	13	5.8	1,725	526	52.6	11.4	34	ssw.	13	5.8

December 26, 1907.—Five kites having a total lifting surface of 316 sq. ft. (29.2 sq. m.) were used. Wire out, 21,700 ft. (6,614 m.), and 21,000 ft. (6,401 m.) at the maximum altitude.

The sky was nearly covered with Ci., Ci.-St., Ci.-Cu., and A.-St. from the northwest during the flight.

Pressure was high along the Atlantic coast, and north of Lake Ontario, while a marked depression was advancing across Montana.

December 27, 1907.—Three kites with a total lifting surface of 210 sq. ft. (19.4 sq. m.) were used. Wire out, 23,500 ft. (7,163 m.) at the maximum altitude.

The sky was nearly covered with Ci.-St. and A.-St. from the west, but after about 9:15 a. m. a practically unbroken sheet of A.-St. prevailed.

A considerable depression was central over Lake Superior, while pressure was high over the Atlantic coast and the South Atlantic States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 28, 1907.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
9:55 a. m...	56.6	13.7	63	ssw.	15	6.7	1,725	526	56.6	13.7	63	ssw.	15	6.7
10:08 a. m...	55.0	12.8	66	sw.	12	5.4	2,946	898	53.2	11.8	....	w.	......	......
10:22 a. m...	53.8	11.8	78	se.	11	4.9	4,602	1,403	49.6	9.8	....	w.	......	......
10:33 a. m...	53.0	11.7	72	se.	8	3.6	5,890	1,795	42.4	5.8	....	w.	......	.....
10:52 a. m...	52.8	11.6	74	se.	9	4.0	6,383	1,946	42.4	5.8	...	w.	......	......
11:03 a. m...	51.0	12.2	70	se.	7	3.1	7,075	2,157	38.7	3.7	....	w.	.....	.....
11:40 a. m...	54.2	12.8	74	se.	7	3.1	6,040	1,841	41.0	5.0	....	w.	......	.....
12:00 m.....	52.6	11.4	75	se.	7	3.1	5,188	1,581	41.5	5.3	....	w.	......	.....
12:13 p. m...	54.1	12.3	72	se.	9	4.0	8,363	1,025	49.3	9.6	....	w.	......	.....
12:19 p. m...	55.3	12.9	69	se.	10	4.5	2,638	804	51.6	10.9	....	wsw.	......	......
12:24 p. m...	55.3	12.9	69	s.	11	4.9	1,725	526	55.3	12.9	69	s.	11	4.9
Dec. 30, 1907.														
11:59 a. m...	56.8	13.8	69	wsw.	20	8.9	1,725	526	56.8	13.8	69	wsw.	20	8.9
12:03 p. m...	57.0	13.9	70	wsw.	20	8.9	3,340	1,018	53.2	11.8	....	sw.	......	......
12:09 p. m...	57.1	13.9	72	s.	18	8.0	4,126	1,258	49.6	9.8	....	sw.	......	......
12:19 p. m...	51.0	10.6	81	s.	14	6.3	4,955	1,510	48.6	9.2	...	sw.	......	.....
12:32 p. m...	50.9	10.5	81	s.	11	4.9	5,941	1,811	45.3	7.4	...	sw.	......	.....
12:42 p. m...	53.8	12.1	78	s.	16	7.2	4,526	1,380	48.6	9.2	....	sw.	......	......
12:59 p. m...	54.5	12.5	71	s.	14	6.3	3,463	1,056	52.2	11.2	....	wsw.	......	......
1:08 p. m...	54.8	12.4	73	s.	13	5.8	2,897	883	52.2	11.2	....	wsw.	......	......
1:12 p. m...	54.2	12.3	73	s.	12	5.4	1,725	526	54.2	12.3	73	s.	12	5.4

December 28, 1907.—Two kites with a total lifting surface of 142 sq. ft. (13.1 sq. m.) were used. The length of wire at the maximum altitude was 15,000 ft. (4,572 m.).

At the beginning of the flight the sky was covered with Ci. from the west, and A.-St. and St.-Cu. from the west-southwest. The lower clouds gradually increased after 11 a. m., the direction changing to west. After 11:50 a. m. the sky was nearly overcast.

Pressure was high over the south Atlantic coast and over Kansas, and was low over the Gulf of St. Lawrence.

December 30, 1907.—Two kites with a total lifting surface of 136 sq. ft. (12.6 sq. m.) were used. The wire out at the maximum altitude was 10,000 ft. (3,048.)

During the first part of the flight the sky was about one-third covered with Ci. from the west and A.-Cu. from the west-southwest. The clouds decreased during the latter part of the flight.

The weather over the eastern portion of the United States was under control of a low central over Lake Erie, and rain or snow was falling over practically the whole region. High pressure, central over Colorado, covered the western part of the country.

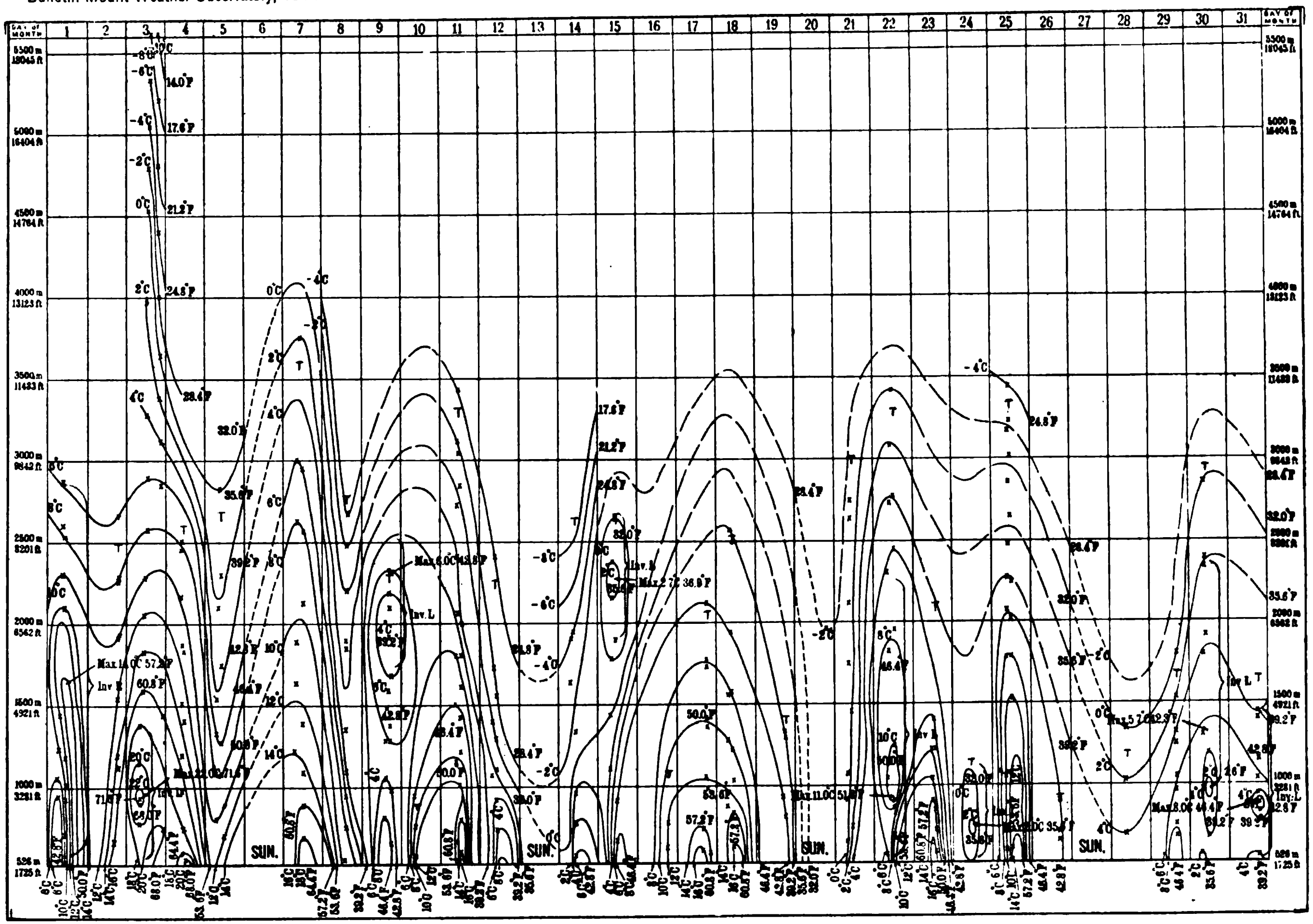
RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
Dec. 31, 1907.	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*
2:35 p.m...	35.7	2.1	33	wnw.	20	8.9	1,725	526	35.7	2.1	33	wnw.	20	8.9
3:02 p.m...	35.8	2.1	32	wnw.	14	6.3	3,744	1,141	24.8	− 4.0	....	wnw.	......	......
3:20 p.m...	36.5	2.5	32	wnw.	12	5.4	6,213	1,894	16.7	− 8.5	....	wnw.	......	......
3:25 p.m...	36.5	2.5	32	wnw.	14	6.3	6,728	2,051	20.3	− 6.5	...	wnw.	......	......
3:42 p.m...	36.7	2.6	32	wnw.	16	7.2	8,716	2,656	16.7	− 8.5	....	nw.	......	......
4:04 p.m...	36.0	2.2	32	wnw.	15	6.7	9,545	2,910	15.8	− 9.0	....	nw.	......	......
4:20 p.m...	36.0	2.2	33	wnw.	13	5.8	9,168	2,794	14.0	−10.0	....	nw.	......	......
4:45 p.m...	34.6	1.4	33	wnw.	9	4.0	7,590	2,314	16.7	− 8.5	....	nw.	......	.....
5:00 p.m...	34.4	1.3	33	w.	8	3.6	6,478	1,975	14.9	− 9.5	....	wnw.	.....	.....
5:15 p.m...	34.0	1.1	35	w.	9	4.0	3,957	1,210	15.8	− 9.0	....	wnw.	......	......
5:42 p.m...	34.0	1.1	47	w.	6	2.7	1,725	526	34.0	1.1	47	w.	6	2.7

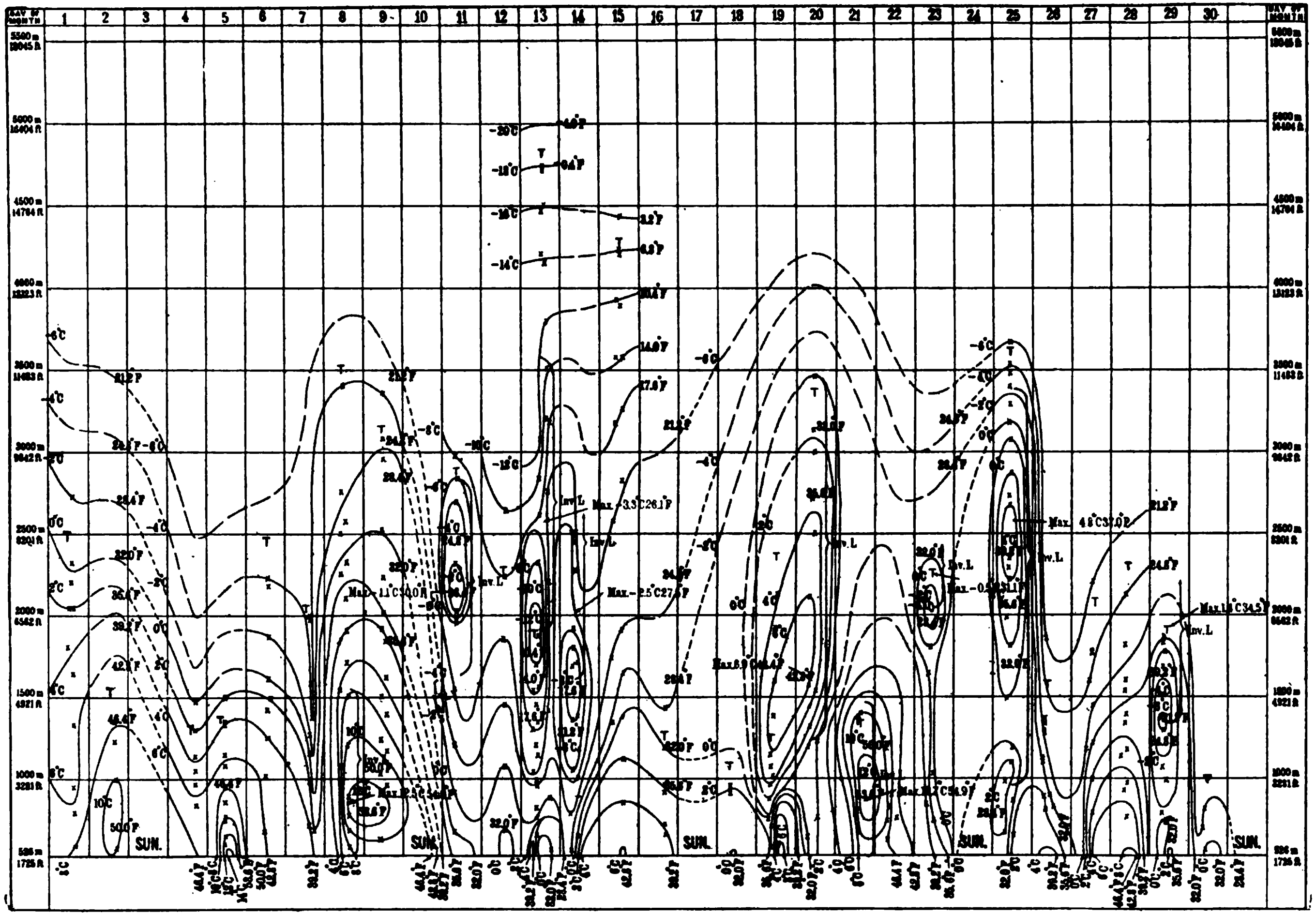
December 31, 1907.—Three kites having a total lifting surface of 200 sq. ft. (19.4 sq. m.) were used. Wire out, 20,000 ft. (6,096 m.), while 19,000 ft. (5,791 m.) was out at the maximum altitude.

The sky was cloudless until near the close of the flight, when a few St.-Cu. appeared near the horizon.

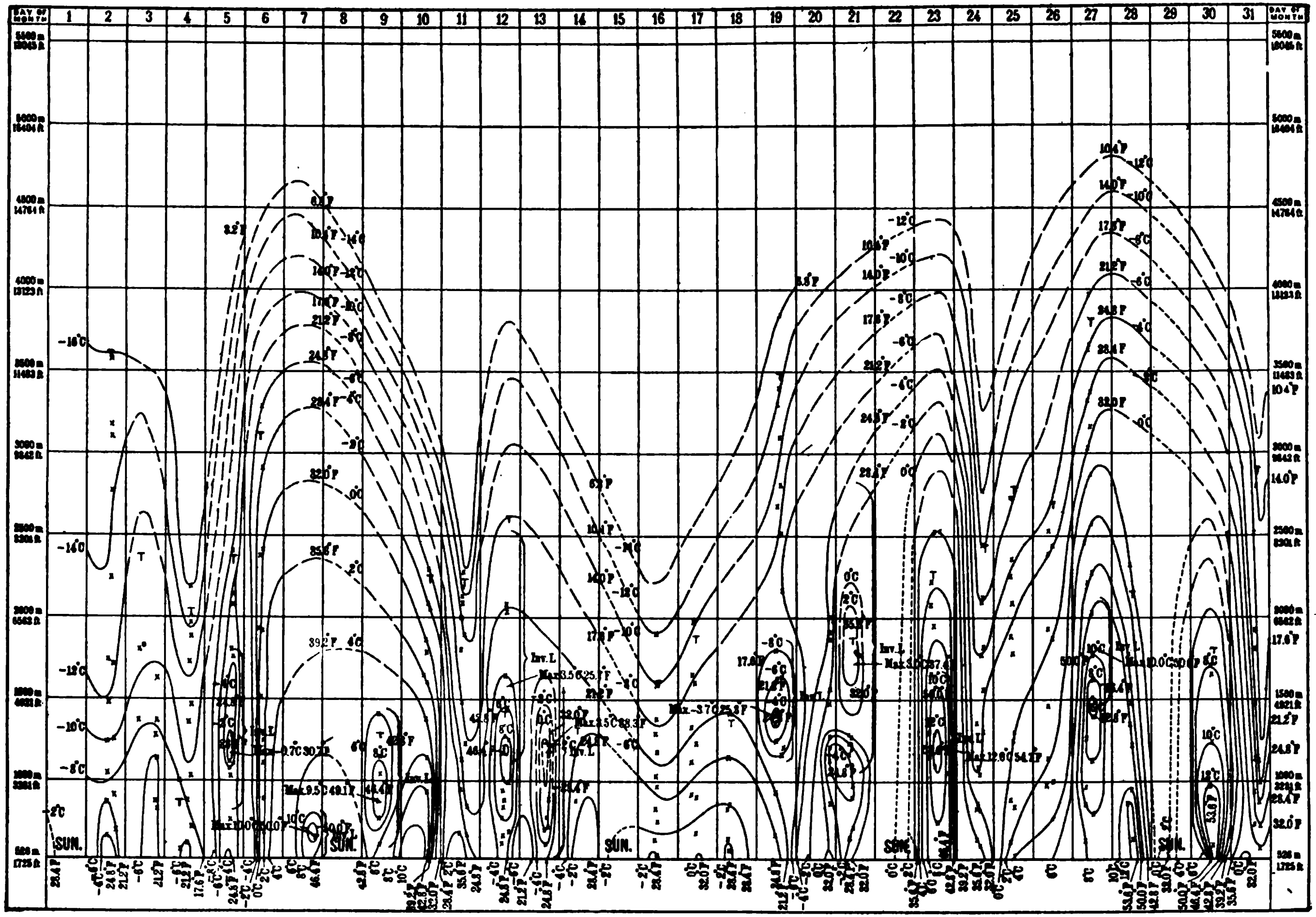
Very low pressure was central over Nova Scotia at 8 a. m., and pressure was high over the Middle and Southern States, with a center over western Tennessee.



Upper air isotherms, October, 1907.



Upper air isotherms, November, 1907.



Upper air isotherms, December, 1907.

U. S. DEPARTMENT OF AGRICULTURE

Vol. I

BULLETIN

Part [illegible]

OF THE

MOUNT WEATHER OBSERVATORY

William J. Humphreys, Ph. D., Director
William R. Blair, Ph. D., Assistant Director

PREPARED UNDER THE DIRECTION OF

WILLIS L. MOORE, D. Sc., LL. D.

CHIEF U. S. WEATHER BUREAU

WASHINGTON
U. S. WEATHER BUREAU
19[illegible]

W. B. No. 391. Issued July 31, 1908.

U. S. DEPARTMENT OF AGRICULTURE

Vol. I **BULLETIN** Part 3

OF THE

MOUNT WEATHER OBSERVATORY

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1908

CONTENTS.

THE LUMINOUS PARTICLE A STRONG MAGNET, AND THE CONSEQUENT PRESSURE SHIFT OF SPECTRAL LINES.

By W. J. Humphreys.

In the Philosophical Magazine for November, 1907, Prof. O. W. Richardson discusses, in an excellent manner, the pressure shift of spectral lines. In outlining his method he says:

Briefly stated, the theory to be developed attributes the displacement of spectral lines produced by pressure to the effect of sympathetic vibrations occurring in the surrounding atoms. The fact that an atom A is emitting light shows that it is surrounded by an alternating field of electric force. This alternating electric field will produce forced vibrations of equal period and, under certain conditions, of like phase in neighboring atoms. The electric field due to the forced vibrations will react on the emitting electron in the atom A and, as will be shown, in such a way as to increase the period of the latter. It will be necessary, then, to calculate the reaction at A due to the forced vibrations set up in an atom at B by a given vibration at A, to sum this up for all the atoms B which occur, and to find the effect of the resultant reaction on the period of A.

After detailed calculation the following equation is obtained:

$$\frac{\delta\lambda}{\lambda_0} = \frac{e^2\lambda^2_0(\mu^2-1)}{6\pi^2 m c^2 a^3},$$

in which $\delta\lambda$ is the change in wave-length λ_0, e the charge of the electron, m the mass of the electron, c the velocity of light, μ the refractive index of the medium for light of the given wave-length λ_0, and a "the radius of the sphere within which it is impossible for the center of an atom of class B to lie. It is evident that a will be of the order of magnitude of the radius of the atom A and have the sum of the radii of A and B as an upper limit."

This equation requires the change in wave-length to be positive, or toward the red, to increase directly as the density or pressure of the the surrounding gas is raised, and finally to be directly proportional to the third power of the wave-length examined. The first two requirements agree with the facts of experiment, but the third does not. The pressure shifts of different lines of even the same element vary greatly, but while there is an undoubted increase in the average shift with increase in wave-length, it is roughly proportional to the first and not to the third power of this value. Besides, the shifts calculated from Professor Richardson's equation are from five to twenty-five times greater than those given by experiment. Presumably then the assumed structure is not very nearly that of the actual atom.

However, some modification of it may bring the calculated and the observed results much closer together. At any rate this is a place where a great deal is needed both of experiment and of theory, and every careful experiment and every theory minutely worked up must bring us nearer to that important goal—the structure and the mechanics of the atom.

In another part of his paper Professor Richardson considers the effect of the magnetic interaction of luminous atoms, based on the assumption "that the magnetic field of any atom is not greater than that which corresponds to saturated iron," and concludes that this action is entirely too small to produce the observed shifts.

But, since the magnetic permeability and the point of saturation of a piece of iron or other substance depends upon its physical condition, and upon the extent to which it is alloyed or combined with other elements, it does not seem likely that the magnetic intensity of any material in bulk is the same as that of its constituent atoms. However this may be it is always safer to rely upon direct experimental evidence whenever obtainable, and this I believe we have for the magnetic condition of the luminous atom, as will be shown below.

Experiment shows that one magnetic field can be acted on by another, and no other method of acting on it has been discovered; that a magnetic field always accompanies an electric current, and no other source of magnetism is definitely known; and that a moving electric charge is an electric current. For these reasons it seems certain that the luminous particle, which is influenced by a magnetic field, possesses a magnetic field of its own, due to moving electric charges, negative, as experiment assures us, in their nature. Besides, we know that spectral lines, when produced in a magnetic field, are split up into parts, one portion of the line having a greater and another a less wave-length than that of the undisturbed line. This means that the electrons are moving in such manner that their periods may be increased or decreased owing to the orientation of the atom to the disturbing field, a condition fully met by assigning to them circular or elliptical orbits. Therefore, assume a structure consisting of one or more circular rings of electrons in orbital motion, all rings coplanar and all revolving in the same sense around a common axis. The electrons in any given ring may be temporarily bunched to some extent or otherwise disturbed, but their normal condition will be one of equal angular distribution, and of equal angular velocity, as viewed from a point on the axis. And all these rings will be inductively bound together, so that to change, by means of an external

magnetic field, the angular velocity of any one is to change in the same sense, but not necessarily to the same extent, the angular velocity of every other.

For the sake of simplicity consider a single such ring of electrons. It has been shown by Langevin[1] that only the angular velocity, and not the orbital radius, of such a ring will vary when it is placed in a field of changing magnetic strength. Therefore the value of its self-induction is a constant, and hence any current induced in it is given by the equation

$$E = L\frac{di}{dt} + Ri,$$

where E is the induced electromotive force, L the self-induction of the circuit, $\frac{di}{dt}$ the rate of change of the current, R the ohmic resistance of the circuit, and i the strength of the current. But in this case the circuit consists of only a single turn, and therefore $E = \frac{dN}{dt}$, or the electromotive force is directly proportional to the rate of change of the number of lines of magnetic force linking with the ring. Besides, as the electrons presumably meet with no resistance in their orbits, $R = 0$. Consequently we get $di = \frac{dN}{L}$. That is, the induced current is always proportional to the total change in the magnetic flux thru the circuit, and of the same sign. And further, every induced current persists without change so long as the new flux thru the circuit is not allowed to vary.

Such a ring of electrons will produce ether vibrations of the wavelength λ determined by the relation

$$\frac{V}{\lambda} = \frac{n\omega}{2\pi} = KS, \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where V is the velocity of light, ω the angular velocity of the electrons, n a numerical coefficient, S the average strength of the magnetic field inclosed by the orbit and due to the moving electrons, and K a constant whose value is determined by the orbit, number, and charge of the electrons. But, whether the wave frequency of the spectral lines is the same as the frequency of the orbital revolutions of the electrons, or only some multiple or submultiple of it, is immaterial to the subsequent argument, as any change in this particular would simply change the value of S. It is only necessary that the wave frequency be directly dependent upon this orbital revolution, so that any changes in

[1] Journal de Physique, (4) 4, 678–692, October, 1905.

the period of this revolution will produce proportional changes in the wave frequencies of the spectral lines.

Since V is either constant or approximately so we get from equation (1),

$$-\frac{Vd\lambda}{\lambda^2} = KdS \text{ . . . . } (2)$$

Therefore from (1) and (2),

$$-\frac{d\lambda}{\lambda} = \frac{dS}{S} \text{ . . . . } (3)$$

But dS can be obtained by bringing a magnetic field of strength H to bear on the particle, in which case (3) becomes

$$-\frac{d\lambda}{\lambda} = \frac{H}{S} \text{ . . . . } (4)$$

By substituting H for dS in (2) we get

$$\frac{d\lambda}{H\lambda^2} = C, \text{ a constant. . . . . } (5)$$

But this is the well-known Zeeman law, and therefore it appears quite likely that the assumed ideal particle is closely akin in structure to the actual luminous particle. In general such particles, as the distance between them changes, will be mutually affected inductively. When their north poles or their south poles face each other the wave frequency will be increased and the wave-length decreased as they mutually approach, since in this case the induction will be such as to increase the current, that is, to increase the orbital speed of the electrons; but as they recede, like poles still facing each other as before, the induction will be such as to increase the wave-length. When, however, the north pole of one faces the south pole of another, the wave-length will increase as they approach and decrease as they recede. In all cases, then, the mutual approach of luminous atoms means a shifting of their spectral lines to the red or to the violet, as the case may be, while their recession is accompanied by a corresponding restoration of the lines to their undisturbed positions—their positions when the luminous gas is very rare, and the lines narrowest and best defined. Presumably, therefore, the widths of spectral lines are due in large measure to the mutual induction of their luminous atoms, the extent of which action must necessarily be independent of the absolute strengths of their magnetic fields. That is, a weak field will affect another equally weak field by the same proportion of itself that two strong ones similarly situated will affect each other. But if their fields are very weak, only a nearly symmetrical broadening of the spectral lines will be produced, since in this case the particles in their

movements under the influence of temperature will approach almost equally close together, whether they face so as mutually to attract or to repel, that is, so as thru induction to increase or to decrease the orbital periods of their electrons. If, however, their magnetic fields are strong, the effect will be a broadening, together with a shift of the maximum intensity to the red, since when attracting and thus mutually inducing countercurrents, they will get distinctly closer together, each into the stronger portion of the other's magnetic field, where the induction is correspondingly greater, than they will when the reverse is the case.

It remains then to find the strength of their fields, and this is easily done by the use of equation (4), in which all the terms except S are directly measurable. By substituting known values for these terms, we get $S=45\times10^7$, approximately, and consequently conclude that the magnetic field of a luminous particle is some thousands of times that of the most powerful electromagnet, and that therefore an unsymmetrical broadening or shift of the order measured is to be expected.

Particles with such strong fields darting about under the influence of temperature would face each other and whirl each other about in a manner analogous to that assumed by Ewing[1] for the molecules of hot iron, and to an extent well nigh independent of the relatively feeble field of any electromagnet. And an independence of this nature seems to be demanded by the Zeeman effect, since the shifted portions, the increased in wave-length and the decreased, of any spectral line are of nearly if not quite equal intensity.

[1] Magnetic Induction in Iron and Other Metals, p. 334.

NOTE ON THE DIFFERENCE BETWEEN ANODE AND CATHODE ARC-SPECTRA.

By W. J. Humphreys.

It was noticed long ago, by Lockyer among others, that the spectrum produced by an electric arc depends in part upon the portion of the arc examined. This difference, which may be very pronounced when the regions near the opposite poles are contrasted, has been studied by Thomas,[1] Baldwin,[2] Foley,[3] and Beckmann.[4]

While their results differ in minor details, due no doubt to differences in the poles and in the methods of observation, they all agree in the essential point, that is, that other things being equal the metallic lines are most pronounced near the negative pole and least conspicuous near the positive pole. Further, they all agree in attributing the spectra of the two poles to unequal concentration of the material producing the lines, but they do not agree as to the cause of this unequal concentration. The first three attribute it chiefly to an electrolytic action in the arc causing the electropositive particles to accumulate on and around the negative pole. Foley, for instance, decides positively in favor of electrolysis, but claims that convection currents due to heated gases may even mask the true electrolytic process.

On the other hand, Beckmann declares against electrolysis. He claims that if there is electrolysis in the arc, then when the poles contain both potassium and manganese the potassium must appear at the negative pole and the manganese at the positive. But he says that he found no such separation, and that therefore electrolysis is absent; that only convection, diffusion, and distillation are involved, and that sometimes the one and sometimes the other, as circumstances are changed, must predominate.

I had often noticed differences in the intensity of metallic lines from regions near the two poles, and a few months ago examined them more minutely. Carbon poles with only impurity traces of metals were used, with the view of making the contrast as distinct as possible. When either pole is heavily charged with one or more

[1] C. R. 119, p. 728, 1894.

[2] Phys. Rev. III, pp. 370 and 448, 1896.

[3] Phys. Rev. V, p. 129, 1897.

[4] Zeit. Wiss. Photog. IV, p. 335, 1906.

metals or their salts the entire arc becomes filled with metallic vapor, probably as a result of distillation, sputtering, convection currents, et cetera, and contrast between the spectra of the two electrodes is not marked. When both poles are so filled there is practically no difference between their spectra. Under such circumstances it is quite likely that minute particles of the salt or metal fill the arc, and that each, being conducting, is on one side the terminous and on the other the origin of a small arc; that is, it carries with itself both a positive and a negative pole, so that the whole arc is largely made up of a great number of infinitesimal arcs that utterly prohibit a study of the contrast between the two poles. Probably, however, this condition is reduced to a minimum when carbon poles with mere traces of metals or their salts are used. At any rate, poles of this nature give very marked contrasts in their spectra.

My observations were made with a large Rowland concave grating, and the trouble from astigmatism was practically avoided by forming an image of a long arc on the screen, standing against the slit, with two small but equal holes in it, one just within the image of the positive pole, the other just within the image of the negative. These two sources gave each its own spectrum, and by using the first order they were kept from overlapping. Everything, therefore, was the same for the two spectra except the sources of the light.

The poles contained traces of aluminium, calcium, chromium, iron, manganese, silicon, strontium, and titanium, all of which showed many times stronger next the negative pole than near the positive. On the other hand the cyanogen bands and the solitary carbon line were more pronounced at the positive pole.

My observations are, therefore, in general accord with those of others, but I can not agree with them as to the sufficiency of their explanations of the reason of this difference, which really seems to suggest what is one, and it may be the only exciting cause of spectrum lines.

It is shown by J. J. Thomson, "Conduction of Electricity thru Gases," that presumably the arc consists mainly of negative corpuscles moving with great velocity from the negative to the positive pole, together with an approximately equal number of positive ions moving much slower in the opposite direction. The principal part of the current then is due to the negative corpuscles that leave the negative pole, ionize the gas of the arc mainly next the positive pole, and finally by their bombardment keep the positive pole itself hot. The positive ions, in a similar manner, heat the negative pole, the most important condition for the maintenance of the arc.

Of course convection, diffusion, and distillation must enter as factors in the distribution of material in the arc, but the positive "rest-atoms," in whatever part of the arc they appear, drift under the voltage applied toward the negative pole, in the neighborhood of which they are met more frequently than elsewhere by the negative corpuscles and that too in their first and violent rush from the cathode. The negative corpuscles of course move, when free, toward the anode, but while some may go on for a time undisturbed others will be slowed up or even unite with positive charges, so that the combined energy of the stream of corpuscles grows less and less as the positive pole is approached.

The location of the strongest part of the spectrum lines next the negative pole is thus assumed to be due to the presence there of the greatest number of negative corpuscles with velocities capable of producing spectrum disturbances in the positive "rest-atoms," and possibly, but by no means certainly, to an accumulation in the same place of the "rest-atoms" themselves. The mere process of ionization, if the structure of the arc is correctly assumed, can not produce spectrum lines, since they are least conspicuous near the positive pole where this phenomenon is most pronounced.

The fact that the negative part of the arc is more concentrated than the positive also tends to emphasize the difference between the anode and cathode spectra, especially when the slit of the spectrometer is parallel to the length of the arc, since in this case a larger proportion of the total light from the negative pole will get thru the slit than of that from the positive. However, the same difference, tho apparently less pronounced, persists when the light from sections at right angles to the arc, but near the poles, is integrated with a concave grating.

It would appear then that one, and it may be the only origin of spectrum lines, is the shocks of "rest-atoms" by swiftly moving negative corpuscles.

My experiments were made in the physical laboratory of the University of Virginia, and I thank Professor Smith and President Alderman for their kindness in placing its facilities at my disposal.

TEMPERATURE INVERSIONS AT THE MOUNT WEATHER OBSERVATORY.

By Alfred J. Henry.

In Part I of this volume, page 58, the writer made some remarks upon the use of upper air data in weather forecasting. The present paper is a continuation of that subject with especial reference to the phenomenon of temperature inversions.

The treatment of inversion phenomena must necessarily be somewhat incomplete since less than a year's observations are at hand as may be seen from the statement below.

Table 1.—*Days with temperature inversions at Mount Weather, Va.*

Month.	Days with flights.	Days with inversions.	Per cent.
1907.			
July	27	6	22
August	27	10	37
September	25	14	56
October	27	13	48
November	26	19	73
December	26	17	65
1908.			
January	27	21	78
February	25	23	92
March	26	20	77
Total	236	143	61

The frequency of inversions for the nine months, July to April, as above determined, is 61 per cent; that is, inversions occurred on 61 per cent of the days on which flights were made. This figure is probably too low since on a number of days the kites did not reach the stratum of most frequent inversions. Days on which isothermal conditions prevailed between any two or more levels in the free air were not considered.

Inversions were most frequent in winter and least frequent in summer. In February 92 per cent of the flights showed inversions, in January 78 per cent, and in March 77 per cent, or an average of 82 per cent for the three months. At Pavlovsk, near St. Petersburg, Russia, the average for the year 1904, as determined by M. Rykatchew[1], was 43 per cent; for the nine months corresponding to the period of

[1] Note preliminaire sur les inversions de la temperature d'apres les observations faites au moyen de cerfs-volants a'Pavlovsk en 1904. Hann-Band der Meteorologischen Zeitschrift S. 174.

observations at Mount Weather it was 51 per cent. At Berlin, Germany, according to Doctor Assmann,[1] inversions occur on about 50 per cent of the days in a year. At Hamburg, however, on only 38 per cent. The low percentage at Hamburg is explained on the ground that the flights at that point did not always reach the inversion level.

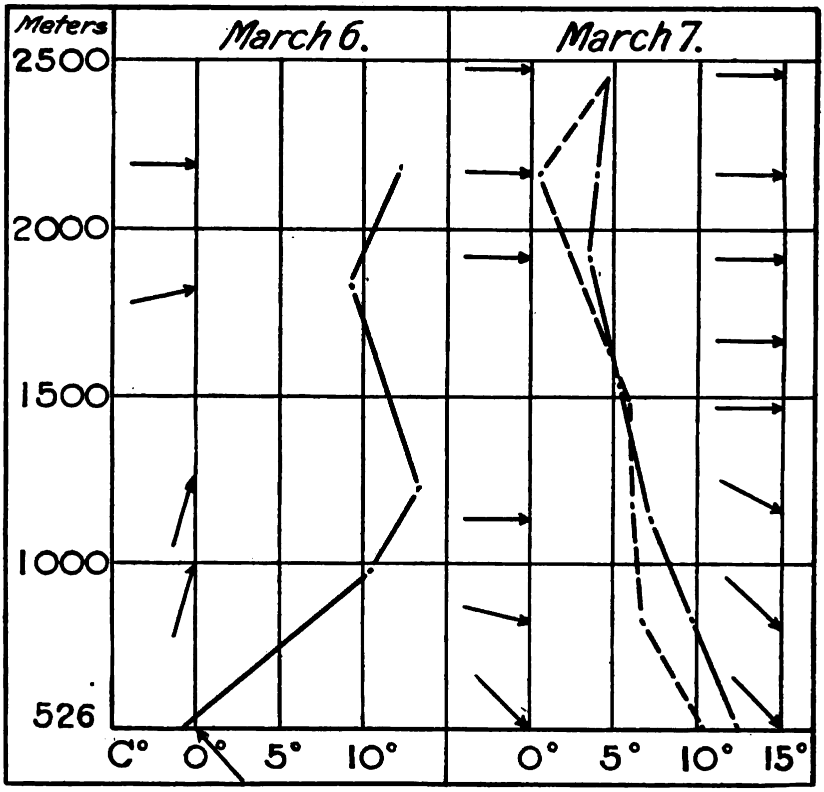

FIG. 1.—Temperature gradient plots, March 6-7, 1908. The broken line under March 7 indicates the descent.

An inversion layer, as that term is used in this paper, is defined by the two points in the flight between which the vertical temperature gradient is plus instead of minus. In this view of the case it may happen that the temperature at the upper limit of the flight may be greater than at the earth's surface; an inversion in fact, had there been no intermediate readings. Suppose, however, the temperature at an intermediate point to be higher relatively to the earth's surface than the temperature at the upper level; the limits of the inversion

[1] Ein Jahr simultaner Drachenaufsteige in Berlin und Hamburg, Beiträge zur Physik der freien Atmosphäre, Erster Band S. 39.

would then be included between the earth's surface and the intermediate point. A typical case in point is afforded by the flight of March 6 (see fig. 1), in which the first inversion layer is reckoned from the ground to 1,238 meters, and the second from 1,845 to 2,196 meters, altho the temperature at the highest point reached by the kite was several degrees higher than on the ground at the same time.

The definition of an inversion here given is not to be considered as final or as conflicting in any way with previous definitions printed in this bulletin. It would perhaps be more proper to call the inversions so defined as regions or layers of positive temperature gradients, and it would also be proper to speak of layers or regions of minus temperature gradients. The length of these terms is, however, objectionable.

An international agreement on what shall constitute an inversion is highly desirable.

In determining the level of an inversion the mean of its upper and its lower limit has been assumed as the mean level of the phenomenon; consequently all flights in which the upper limit of the inversion was not reached have been excluded from the computations.

ZONE OF GREATEST FREQUENCY.

The zone of greatest frequency of inversion in the free air above Mount Weather is found in the level between 1,000 and 1,500 meters above sea level, or in round numbers, 500 to 1,000 meters above the mountain top.

The frequency of inversions in the various altitudes above the mountain top may be seen in the following table to which have been added, for the sake of comparison, like results for Hamburg and Berlin. The values for Hamburg–Berlin were taken from Doctor Assmann's paper before cited.

TABLE 2.—*Percentage of inversions in the different levels.*

Place.	Earth to 200 m.	200 to 500 m.	500 to 1,000 m.	1,000 to 1,500 m.	1,500 to 2,000 m.	2,000 to 2,500 m.
	%	%	%	%	%	%
Mount Weather	21.0	25.0	28.0	18.0	6.0	2.0
Hamburg	6.9	39.5	31.3	18.9	4.7	3.5
Berlin	4.5	37.6	28.4	21.6	4.5	3.4

The above figures show wide variance in the two levels nearest the earth's surface and tolerably good agreement elsewhere. If, however, the values for "earth to 200 meters" and "200 to 500 meters" be combined, the following close agreement with European stations is obtained, viz:

Mount Weather, earth to 500 meters......	46.0 per cent.
Hamburg, earth to 500 meters............	46.4 per cent.
Berlin, earth to 500 meters...............	42.1 per cent.

At altitudes above 2,500 meters (above sea level) inversions were seldom observed, there being but nine such during the period of observations.

GROUPS OF INVERSIONS.

The inversions of temperature observed at Mount Weather may be classed in several ways; for the purpose of description, however, it seems convenient to classify them according to their probable origin; accordingly the three following groups are proposed, viz:[3]

1. Inversions of purely local origin such as are produced by the radiation of heat from the earth's surface under certain favorable atmospheric conditions, the formation of fog, etc.

2. Inversions whose origin is to be traced back to that of areas of low pressure which approach the mountain from the west and southwest, bringing with them air of higher temperature than that experienced on the mountain. The higher temperature of the air thus imported is observed first in the air layers at some distance above the mountain top, and thus a marked inversion, sometimes of great vertical extension, is produced. This group is distinctly marked and might be called the cyclonic type of winter, spring, and autumn. It has not been observed in summer.

3. The third group is the greatest numerically, and it embraces inversions which doubtless arise from several different causes, chief of which is probably the unequal cooling of the air column on the front of an anticyclone, as will be discust at greater length in the concluding part of this paper. Other probable causes of inversions belonging to this group are (1) the eastward drift of shallow disconnected masses of warmer air which pass over the station in the general atmospheric drift, and (2) differences of temperature which exist on the boundary between two differently directed wind systems, the one superposed upon the other.

Under cause (1) referred to above, it may be remarked that the existence of shallow, disconnected bodies of relatively warm air in the general air currents is assumed in analogy with the occurrence of similar phenomena on the earth's surface.

[3] The influence of humidity on inversion phenomena could not be determined since the necessary data are wanting. The details as to the times the kites may have been in the clouds are also lacking in a few cases.

From the point of view of the weather forecaster inversions belonging to the first group are of little significance. Their number is not large, and their occurrence is mostly due to local conditions, altho fog sometimes occurs as a result of general weather conditions. Fog is much more frequent at Mount Weather than at stations situated on a plain or under less-marked surface relief; thus during the year 1907, excepting the month of October, dense fog was observed in Washington, D. C., on eight days only as against one hundred and one days on Mount Weather.

Inversions of the second group are almost invariably observed when a region of low pressure situated in the west or southwest advances against a strong area of high pressure central directly over the Middle Atlantic States or along the Atlantic coast, with its crest over New England. The surface winds at Mount Weather, under pressure distribution as above described, are southeasterly, and relatively cool and moist; moreover, they do not shift to a westerly quarter until the approaching cyclone is well over the station. This fact is not peculiar to Mount Weather, but is common to the eastern slope of the Appalachians from northern Georgia to southern Pennsylvania. The kite observations at Mount Weather show that the easterly surface current is quite shallow, and that it gives way to a westerly current at a few hundred meters above the mountain. It seems probable that this current, after ascending the eastern slope of the mountain, is turned back upon itself and merges with the general westerly winds at a small altitude above the mountain.

TEMPERATURE OF THE SURFACE WINDS.

At this point a digression will be made in order to show the relation between wind directions and local surface temperatures.

In preparing Table 3, which appears on the next page, the self-registering records of temperature and wind direction were used; thus for January 2,232 hourly observations or three years' records were considered. The wind direction for each of the eight principal points of the compass and the corresponding temperatures were tabulated separately and the means calculated. The table consequently shows the percentage of the time that the wind blew from each of the eight principal points of the compass and also the amount of the departure of the corresponding temperatures from the mean for the month. Thus it will be seen that for the year the winds from northwest to southeast by way of north are cold winds, and that the west, southwest, and south winds are the warm winds. The chief winds in point of frequency are the northwest and the

southeast, which it may be remembered blow across the summit almost at right angles to the general trend of the ridge. The wind rarely blows in a direction parallel with that of the ridge.

The following table shows the departure of the temperature of the wind from each of the eight principal points of the compass from the mean for the month:

TABLE 3.—*Temperature of the winds at the Mount Weather Observatory.*

[From the records of self-registering instruments.]

Direction.	January.		April.		July.		October.		Year.	
	Departure from mean.	Per cent of wind from—	Departure from mean.	Per cent of wind from—	Departure from mean.	Per cent of wind from—	Departure from mean.	Per cent of wind from—	Departure from mean.	Per cent of wind from—
	°		°		°		°		°	
North	− 5.5	6	+ 2.2	5	− 3.1	3	+ 1.7	6	− 1.2	5
Northeast	− 2.1	1	− 6.6	1	0	1	− 2.2	5	− 2.7	2
East	− 6.7	3	− 7.4	3	− 2.2	5	− 1.8	10	− 4.5	5
Southeast	− 1.7	22	+ 3.0	16	− 0.7	24	+ 2.2	17	+ 0.7	20
South	+ 6.6	9	+ 9.5	9	+ 0.7	13	+ 4.3	10	+ 5.3	10
Southwest	+13.7	5	+ 9.3	5	+ 1.4	4	+ 6.2	3	+ 7.6	4
West	+10.9	12	+ 6.4	9	+ 1.6	15	+ 6.9	11	+ 6.4	12
Northwest	− 3.9	41	− 4.3	52	− 0.2	34	− 3.9	39	− 3.1	42

CHARACTERISTICS OF INVERSIONS.

The southwest wind at Mount Weather is preeminently a warm wind, altho its warmth is largely drawn from lower latitudes, while easterly winds are relatively cool, since their temperatures are largely determined by those which prevail for the time being in middle Atlantic coast districts. It is easily seen, therefore, that an inversion in temperature will result whenever these cold, easterly, surface winds are overrun by warm, southwesterly winds.

During the winter season, but more especially in March and April, the drift of cyclones and anticyclones produces at times strong surface temperature gradients between regions of cold, northerly and warm, southerly winds. A difference in temperature of as much as 16.7° C. in 226 kilometers (30° F. in 140 miles) is not unusual. The weather map for March 6, 1908 (8 a. m., seventy-fifth meridian time), here reproduced, Chart X, illustrates the general weather conditions under which strong gradients are produced, and fig. 1 shows the vertical temperature gradients between the summit of Mount Weather and 2,196 meters elevation (above sea level) between 1:19 and 4:07 p. m. of the day in question. The inversion in this case is representative of group No. 2.

The important feature shown by the map is the existence of an unusually large mass of warm air overlying as it does the whole of the

Gulf States, the middle Mississippi Valley, the Ohio Valley and Tennessee. This warm air is advancing rapidly northeastward and directly displacing the cold surface air which overlies New England, the Middle Atlantic States, and the lower Lake region.

When the kite flight at Mount Weather on March 6, 1908, was made the wind at the surface was still from the southeast and relatively cold; at 450 meters above the summit, however, the wind had shifted to the south-southwest with a temperature of 9.6° C. (17.3° F.) higher than at the surface. At the highest point reached by the kite the temperature was 12.2° C. (22.0° F.) higher than at the surface at the same time. Unfortunately this flight does not give a measure of the depth of the warm, southwest current, but another flight on March 18, under similar conditions, gives an approximate depth of 1,830 meters (6,000 feet) on that date.

The evidence of this map, amply supported by that of others in which the pressure distribution was quite similar, shows that the cold of a region of maximum pressure, as shown on Chart X, is confined to the lower layers of the air; also that the cold layer is unexpectedly shallow, especially on the western border of the region of maximum pressure. It is interesting to note, in this connection, that the direction of the wind, while southeast at the surface, invariably shifts to a westerly quarter at a small height above the station. The following statement, taken from eight flights under similar pressure conditions, brings out this fact clearly:

TABLE 4.—*Wind direction in different altitudes above Mount Weather, Va.*

[Altitudes above Mount Weather in meters and feet.]

Wind direction.	Surface.	224 m., 734 ft.	474 m., 1,555 ft.	724 m., 2,428 ft.	974 m., 3,194 ft.
South-southeast	0	1	0	0	0
Southeast	7	0	0	0	0
South	0	4	3	2	0
South-southwest	0	1	2	1	0
Southwest	1	2	3	4	6
West-southwest	0	0	0	1	2

From the foregoing it will be seen that at 474 meters (1,555 feet) above the station the easterly winds of the surface have disappeared, and at 974 meters (3,174 feet) all the winds are westerly. These warm westerly winds clearly overrun the cooler surface winds and are thus a source of precipitation far in advance of the center of the cyclone.

A composite plat of the vertical temperature gradients in the same number of cases shows an inversion from the ground up to 474 meters

(1,555 feet) above the mountain and a very slow decrease in temperature, with increased altitude thereafter up to about 2,474 meters above the earth's surface.

The third group of inversions is numerically the largest. Inversions of this class occur chiefly in the transition zone between a passing cyclone and an incoming anticyclone, and generally with pressure above 762 millimeters (30.00 inches). The inversion layer is generally of small vertical extension and is nearly always found in the layers between the summit of the mountain and 2,500 meters above sea level. A good example is shown in fig. 2., February 26, 1908.

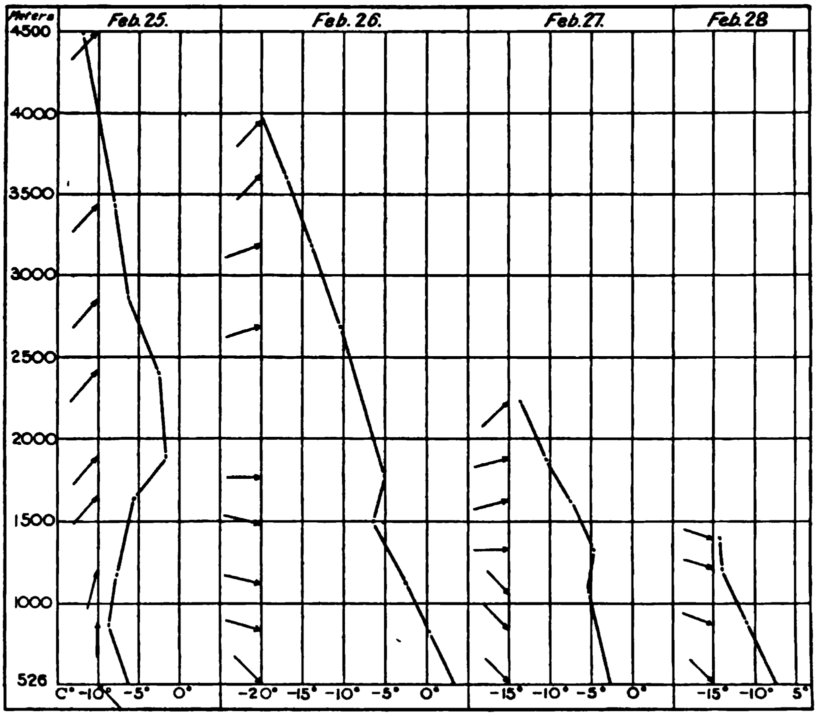

FIG. 2.—Temperature gradient plots and wind directions, February 25–28, 1908,

It seems probable that inversions of this class are brought about in several ways, chief of which is the unequal heating, or cooling, as the case may be, in the various atmospheric levels within the range of the kite flights.

In order to determine the nature of the daily temperature changes in the air column over the station, all flights made on consecutive days were charted and the approximate temperatures at the several

levels were taken out. Unfortunately it was not always possible to reach the same altitude each day and the omission of flights on Sundays still further reduced the possibility of making useful comparisons. In comparing the temperatures found in the higher layers, that is above 1,500 meters (above sea level), the effect of diurnal variation was disregarded. At the surface it was always possible to compare the temperature of any hour with that of the corresponding hour of the preceding or succeeding day; and this was done.

There is, to be sure, some uncertainty as to the values for 750, 1,000, and 1,250 meters altitude on account of the diurnal variation on the days when the hours of observation were widely separated.

WARMING AND COOLING OF AIR STRATA—EXCEPTION TO RULE.

It was found in general that both the warming and the cooling began first in the higher layers and extended to the earth's surface in twenty-four hours or less. There appears to be, however, at least one important exception to this rule, viz, a rise or a fall in temperature which apparently begins both aloft and at the earth's surface about the same time, but with an intermediate level of zero or a very small change.

Thus the flight of January 29, 1908, made between 11:05 and 11:50 a. m., as compared with the flight made on the previous day between 7:40 and 9:25 a. m., shows the following changes, in degrees, centigrade, plus indicating a rise, minus a fall:

Elevation above sea level.	January 28–29.	January 29–30.*
Meters.		
526	+4.4	−7.8
750	+2.2	−9.3
1,000	+0.9	−1.9
1,250	−0.3	0.0
1,500	+3.4	−5.8
1,750	+4.5	−6.5
2,000	+4.0	−6.5
2,250	+1.6	−5.8
2,500	....	−5.4

* The flight of January 30 was made between 10:09 a. m. and 12:55 p. m.

Here it will be observed there is a plane of zero change both on January 29 and 30. In one case the temperature was rising, in the other falling.

The unequal heating and cooling can hardly be classed as purely accidental, since it occurs rather frequently and generally under similar conditions of pressure distribution. In this connection attention is called to the plot of vertical temperature gradients on February 25, 26, 27, and 28, 1908, fig. 2, which illustrates a typical winter inversion

of the third group. The weather conditions on February 25 were as follows: A strong area of high pressure occupied New England and the Middle Atlantic States and a region of low pressure extended from the upper Lakes southward to Mississippi. The southern portion of this low was central the morning of the 26th a few miles east of Mount Weather, while the main depression covered Lake Huron. On the morning of the 27th the southern end had moved to the southern New England coast, and by the morning of the 28th it had advanced to the Canadian Maritime Provinces. The plot of the vertical temperature gradient on the 25th shows the most pronounced inversion at about 1,750 meters and southwest winds prevailing from 1,000 meters to the upper limit of the flight, 4,496 meters. The temperature as compared with that of the previous day had risen, as was to be expected. The greatest rise, so far as could be ascertained, was 8.4° C. (15.1° F.) at the 1,500-meter level, apparently just below the marked inversion. On the morning of the 26th, with the center of the secondary low directly east of the station, the following changes from the previous day were noted. The temperature in the higher layers had begun to fall, there being a drop of 10° C. (18° F.) at 4,000 meters above sea level. The fall thus begun evidently was being propagated downward, and at the time of the flight had reached the 1,500-meter level. Below that level the temperature, as compared with that of the day previous, had risen; therefore with falling temperature in the higher layers and rising temperature in the layers next to the earth there must naturally be an inversion layer along the surface which separates the air masses in which the course of the temperature is oppositely directed. As this phenomenon is not unusual, it may be stated as follows: When cooling sets in in the higher layers of the atmosphere at a relatively short distance in the rear of a cyclone an inversion layer will generally be found separating the uncooled air near the ground from the cooled air aloft. The temperature changes from the 25th to the 26th follow:

Altitude above sea level.	
526 meters (surface)	+ 9.6
1,000 meters	+ 7.2
1,500 meters	— *0.3*
2,000 meters	— 4.4
3,000 meters	— 5.8
4,000 meters	—10.2

As a result of the above changes, the vertical gradients on the 26th both above and below the inversion level more closely approach the adiabatic rate for dry air, viz, 1° C. per 100 meters. It should also be

noted that whereas but a single system of southwest winds prevailed on the 25th, on the 26th there are apparently two with the inversion layer as a bounding surface. At the inversion level west winds prevail, above that level they have a southerly component, below a northerly. This distinction is seen even more clearly on the 27th, with, as before, the inversion layer as the bounding surface.

On the 27th the changes of temperature from the day previous were as follows:

Altitude above sea level.	
526 meters (surface)	—6.1
1,000 meters	—3.9
1,500 meters	+0.2
2,000 meters	—5.2

Here, as on the day previous, the level of practically zero change is at 1,500 meters. The inversion layer on this date appears at a lower level than on the day previous.

HORIZONTAL EXTENSION OF WARM CURRENTS.

As throwing additional light on the subject of inversions in general and in particular of that class whose origin can be traced back to a warm westerly or southwesterly air current, fig. 3, has been prepared. This illustration contains the vertical temperature gradient plots of March 17, 18, 19, 20, and 21, 1908, a period of generally unsettled, rainy weather east of the Mississippi River, with sharp surface temperature gradients, thunderstorms, and a very rapid easterly movement of the lower layers of the atmosphere. (For further details see a file of the daily weather maps.) The gradient plots on those dates have also a special interest in that they show the cycle of changes induced by the passage of a region of minimum pressure over the station followed by an area of maximum pressure.

TABLE 5.—*Daily changes in temperature (° C.) at the several altitudes.*

1908.	Time.		Altitude above sea level (meters).								
	From—	To—	526	750	1,000	1,250	1,500	1,750	2,000	2,250	2,500
March 17 ..	9:09 a. m.	11:40 a. m.	— 6.1 (— 7.0)*	— 2.8	+ 0.7	+ 4.6	+ 4.8	+ 5.1	+ 5.1	+ 5.8	+ 6.2
March 18....	1:00 p. m.	2:35 p. m.	+ 7.9 (+ 3.0)*	+ 6.5	+ 7.2	+ 8.1	+ 8.5	+ 9.2	+ 9.6	+10.1	+10.0
March 19.. .	9:14 a. m.	4:15 p. m.	— 4.2 (+ 8.4)*	+ 4.5	+ 0.1	— 4.1	— 2.9	— 0.9	— 1.4	— 2.7	— 4.0
March 20....	1:40 p. m.	3:15 p. m.	—11.9 (—15.0)*	—18.5	—18.8	—19.6	—21.5	—20.5	—20.6	—19.8	......
March 21....	7:20 a. m.	11:18 a. m.	— 2.8 (— 3.3)*	— 0.6	— 0.2	+ 3.7	+ 4.8	+ 1.1	+ 0.8	+ 0.7	......

* Actual change from the even hour of the day previous.

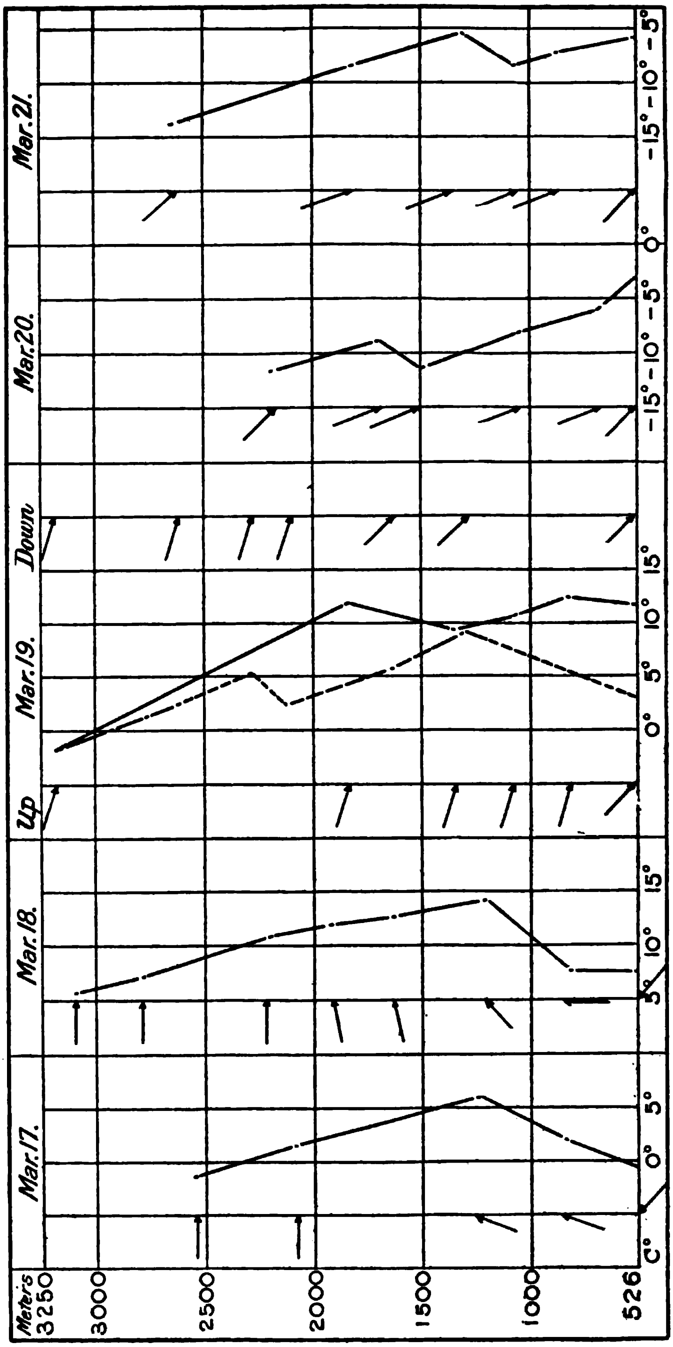

FIG. 3.—Vertical temperature gradients and wind directions, March 17–21, 1908. The broken line on the 19th indicates the descent.

The plot of the 17th shows an inversion from the mountain top to an altitude of 1,250 meters above sea level. It is now purposed by the aid of Table 5 to trace this inversion thruout the several days it appears in the diagram. On the 17th the temperature of the air column between the earth's surface and 224 meters above fell. From the last-named level to the upper limit of the flight it uniformly rose by the amounts shown in Table 5. As the center of the region of low pressure approached the mountain the rise in temperature in all levels became more pronounced, being however, relatively greatest in the highest levels reached. (See the 18th.)

The gradient plot of the 18th shows plainly the effect of this increase in temperature. The inversion on that day is between 800 and 1,200 meters and the increase in temperature above that level has greatly weakened the temperature gradient so that now the whole air column as far as explored is almost isothermal. This seems to be a characteristic feature of the front of a low. On the morning of the 18th the center of the region of low pressure was in Oklahoma, distant from Mount Weather about 1,770 kilometers (1,100 miles), altho there was a narrow trough-like northeastward extension from the center into the Ohio Valley.

It seems quite probable from the evidence of the kite flights at Mount Weather and the isobars of the daily weather map that on the 18th a body of warm air extended from the Middle Atlantic States to Oklahoma; except that over the former, including the Appalachian region, the warm air had not yet reached the surface. Along the northern border of this warm air mass thunderstorms prevailed. By the morning of the 19th the low center has past to the eastward of the station and was central off the middle Atlantic coast. The surface winds at Mount Weather had shifted to northwest and the upper winds had acquired more of a northerly component than on the 18th. The temperature gradients on both the up and the down flights of the 19th are given. The up flight was made between 9:14 and 11:38 a. m. and the down flight between 1:42 and 6:21 p. m. The up flight showed a rise in temperature, as compared with the previous day, in the layers next to the earth's surface, and a fall between 1,250 and 2,500 meters. As will be seen from Table 5 the cooling at the 1,750-meter level was not so great as in the respective levels immediately above and below. (See also March 6 and January 30.) On the down flight the evidence of unequal cooling is more striking. As will be seen from the plot, there are inversions between about 2,112 and 2,286 meters, also between the surface and 1,280 meters. The observation

at 2,286 meters was made at 3:12 p. m.; at 2,112 meters, 34 minutes later or at 3:46 p. m.; the next observation was made at 1,630 meters at 3:58 p. m., the next at 1,287 meters at 4:15 p. m. and finally the surface was reached at 6:21 p. m. The time occupied by the descent from 2,286 to 1,287 meters was therefore a little less than an hour and while the temperature of the air column was falling during the descent it is believed the slight cooling which must have occurred, while the kites were passing from one level to another, can be disregarded, except from 1,287 meters to the mountain top, where the difference in time amounted to about two hours. The surface reading at 6:21 p. m. may be as much as 1.0° C. too low. These details in connection with the gradient plot above referred to indicate marked irregularity in the cooling of the several strata between 2,286 meters and the earth's surface.

On the 20th the fall in temperature was nearly uniform thruout the flight, as compared with the day previous, therefore the gradient plot of the 20th should very nearly match that of the 19th as it actually does, except that the inversion is at a slightly lower altitude.

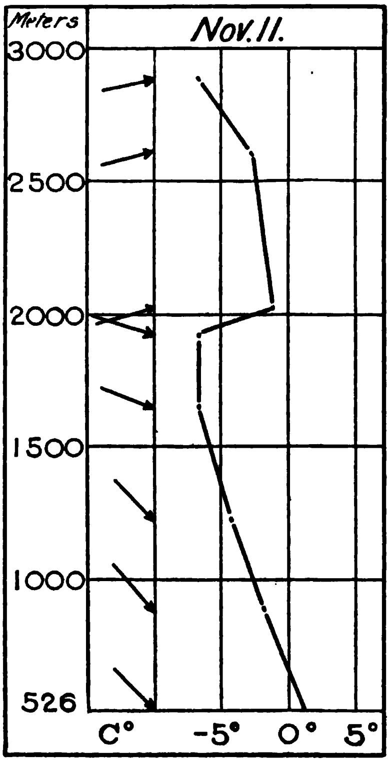

Fig. 4.

On the 21st the temperature rise is more pronounced in the 1,250 and 1,500-meter levels than elsewhere in the flight; thus, at the 1,250-meter level the rise is 3.7° C. (6.7° F.) against a rise of only 0.2° C. (0.4° F.) at the 1,000-meter level. It is easy to see that such inequality in the daily change must produce an inversion.

Inversions have been observed which appear to be the result of air masses having different temperatures and different directions of motion, flowing along the one above the other. Fig. 4 contains a plot of the vertical temperature gradient and the wind direction on November 11, 1907. In this plot a marked inversion appears on the plane dividing the northwest winds from the southwest winds at an altitude of about 2,000 meters.

As previously stated, the cooling that follows the passage of a region of low pressure seems to first begin in the upper layers. One exception only was found, and in that there appears to be no doubt but that the cooling was confined wholly to the layers below 1,500 meters. The cooling was most intense at the surface, 8.4 C. (15.1 F.) diminishing thence upward to 4.7° C. (8.5° F.) at the 1,500 meters level. Above the latter level the temperature rose to the upper limit of the flight, viz, 2,000 meters. The pressure distribution on the earth's surface conformed to the facts as shown by the kite flight.

The kite flight of February 22, 1908. showed a marked fall in temperature between the 750 and 3,000 meter levels, but *not* at the surface of the mountain. The maximum fall, 15.4° C. (27.7° F.) occurred in the 2,000 meter level.

AIR STRATIFICATION.

Among the surface observations incident to the kite flights at Mount Weather was the one described below. This observation clearly shows the mutual relation between pressure and temperature and suggests that the stratification of the air may be in a vertical as well as a horizontal direction. One is accustomed to think of the stratification of the air as regards temperature as occurring mostly in the layers of air which lie horizontally one above the other. In the case in question the air seemed to pass over the station (Mount Weather) in alternately warm and cold masses that must have extended some distance aloft, since the perturbations of the pressure curve at both Mount Weather and Washington were of considerable amplitude.

The observation in question relates to the intrusion of a cold north-northeast wind at the surface of Mount Weather and also at Washington, D. C., on the afternoon of March 18 during the prevalence of a relatively warm upper current from the west, as shown by kite observations earlier in the day. The wind at Mount Weather had been southeast for the greater part of the day, when suddenly, between 4 and 5 p. m., it abated in velocity and shifted first to northerly and then to easterly. The shift of the wind was attended by a sudden fall in temperature amounting to about 4.4° C. (8.0° F.). The same phenomenon was experienced in Washington about a half an hour later, altho the temperature fall at that place was but 2.2° C. (4.0° F.). The fall in temperature and the corresponding rise in pressure are shown in fig. 5. In a couple of hours the wind resumed the direction it had before the occurrence of the phenomenon, but the low temperatures continued until the early morning of the 19th, when the wind shifted to a northwesterly quarter.

The northwest wind is normally a cold wind, except under certain conditions, one of which is that as a region of low pressure and its attendant high temperature passes to the eastward of the station, the

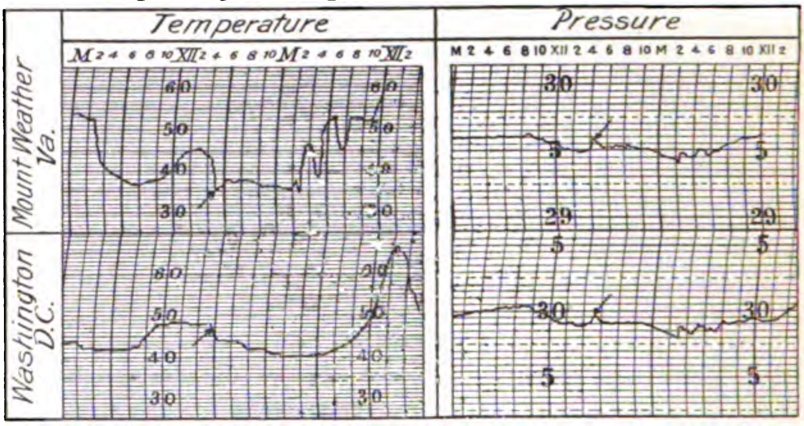

FIG. 5.—Synchronous pressure and temperature curves, Mount Weather and Washington, midday March 18 to noon March 19.

shift of the wind to the northwest is *not* coincident with the fall in temperature. In some cases, as on the day in question, there is a considerable lag. The maximum temperature at Mount Weather, on March 18, 15.0° C. (59.0° F.) was reached at noon and at Washington, D. C., several hours later, both with a northwest wind and at a time when the center of the area of low pressure was over the Atlantic some hundred miles off the New England coast. The vertical temperature gradient at Mount Weather on the 19th of March (see fig. 3) was very weak, in fact the layers between the surface and the 1,750-meter level were almost isothermal, indicating, it would seem, that the warm surface current of air extended aloft some distance.

The daily weather map throws no light upon the origin or the cause of the cold wind herein described. Had it not been for the characteristic thunderstorm "hump" that it produced on the pressure curve, and the appearance of a series of other "humps" during the early morning hours of the next day the phenomenon would perhaps have past unnoticed.

The cause of the disturbances in the pressure curves of both stations on the morning of the 19th doubtless can be referred to the temperature changes that are shown to have occurred at the higher level station, beginning about 2 a. m. of the 19th. These changes appear to have resulted from the movement, over the station, of bodies of alternately warm and cold air, which, judging from the impress left on the pressure curves, must have had a considerable vertical extension.

TABLE 6.—*Inversions observed during the kite flights at Mount Weather Observatory from June, 1907, to March, 1908.*

Date.	526 to 1,000 meters.	Increase per 100 meters.	1,000 to 2,000 meters.	Increase per 100 meters.	2,000 to 3,000 meters.	Increase per 100 meters.	3,000 to 4,000 meters.	Increase per 100 meters.	4,000 to 5,000 meter.	Increase per 100 meters.
1907.		°C.		°C.		°C.		°C.		°C.
June 15			1,006-1,374	.30						
June 26	773		1,052	.32						
June 27			1,634		2,477	.24				
June 29	526		1,191*	.32						
July 3			1,016-1,172	3.85						
July 15	526-924*	.38								
July 20					2,389-2,650*	.06				
July 22							3,581		4,028*	.51
July 25			1,274-1,637	.28						
July 27			1,244-1,820	.43						
Aug. 7	526-881	.06	1,307-1,428	.41						
Aug. 8			1,021-1,205	.69						
Aug. 10					2,187-2,579*	.08				
Aug. 14			1,559-1,844	.81						
Aug. 16	730		1,194	.54						
Do.			1,394-1,588	.93						
Aug. 21	876		1,029	.92						
Aug. 23	526		1,221	.56						
Aug. 26	526-909	.08			2,135-2,249	2.28				
Aug. 28	526-898	.38								
Aug. 31					2,266-2,347*	4.81				
Sept. 2	526		1,226	.19						
Sept. 4			1,172-1,306	.67						
Sept. 6			1,709		2,115	.57				
Sept. 9	848		1,187	.21						
Sept. 10	736		1,524	.11						
Sept. 14			1,518-1,626*	1.48						
Sept 17	896		1,143	.85						
Sept. 19	663-802	2.30								
Sept. 20	526-733	.89								
Sept. 23	526-808	.89								
Sept. 26			1,436-2,443	,49	2,746		3,566	.15		
Sept. 27	526-867	.53								
Sept. 28	526-876	.23								
Sept. 30			1,505-1,993*	.60						
Oct. 1	874		1,646	1.23						
Oct. 2	857		1,007	.13						
Oct. 3	526-908	1.31								
Oct. 8			1,540-1,867	.40						
Oct. 9			1,276-1,530	.91	2,074-2,310*	1.48				
Oct. 15	526-905	.16	1,590		2,286	.53				
Oct. 21	860		1,656	.45	2,631		3,009*	.29		
Oct. 22	526		1,034	.85						
Oct. 24			1,075-1,145	2.43						
Oct. 25	526		1,246	.17						
Oct. 26	878-926*	5.83								
Oct. 30	526		1,312	.51						
Oct. 31	849		1,095	1.91						
Nov. 1	526		1,471	.14						
Nov. 6	526-798	.85								
Nov. 7			1,896		2,059*	1.35				
Nov. 8	526		1,284	.33						
Nov. 9	526-909	.55								
Nov. 11			1,939		2,034	5.79				
Nov. 12					2,049-2,283	.77				
Nov. 13			1,989		2,598	.76				
Nov. 14			1,688		2,115	1.76				
Nov. 15	865		1,145	.21						
Nov. 18	526		1,101*	.50						
Nov. 19	766		1,077	2.00						
Do.	748		1,454	.54	2,183-2,379*	.36				
Nov. 20	881		1,640	1.10						
Nov. 21	709		1,010	1.26						
Nov. 22	526-840	1.66								
Nov. 23					2,045-2,274*	1.66				
Nov. 25	863				2,240	.47				
Nov. 29			1,347-1,936*	1.31						
Dec. 2			1,997		2,281	.88				
Dec. 5	997		1,175	3.76						
Dec. 6			1,171-1,810	1.00						
Dec. 7	526-665*	1.58								
Dec. 9	526-867	1.38								
Dec. 11			1,660-1,946	.73						
Dec. 12			1,074-1,550	.90						
Dec. 13	526		1,175*	1.14						

TABLE 6.—*Inversions observed during the kite flights, etc.*—Continued.

Date.	526 to 1,000 meters.	Increase per 100 meters.	1,000 to 2,000 meters.	Increase per 100 meters.	2,000 to 3,000 meters.	Increase per 100 meters.	3,000 to 4,000 meters.	Increase per 100 meters.	4,000 to 5,000 meters.	Increase per 100 meters.
1907.		°C.		°C.		°C.		°C.		°C.
Dec. 14			1,106-1,324*	1.83						
Dec. 19			1,148-1,383	1.62						
Do			1,684-1,873	1.26						
Dec. 20			1,199-1,404	.78						
Dec. 21			1,172-1,703	1.28						
Dec. 23	526		1,264	.12						
Dec. 25			1,428-1,650	.41						
Dec. 26	818		1,091	.52						
Dec. 27	526-909	.91								
Dec. 31			1,894		2,051	1.27				
1908.										
Jan. 1					2,366-2,742	.08				
Jan. 3			1,548-1,720	1.16						
Jan. 4	526-1,021	0.49								
Jan. 8			1,413-1,614	.50						
Jan. 10	526-802	.72	1,415-1,757	1.17						
Jan. 11	526-870	2.00			2,183-2,211	3.35†				
Jan. 13			1,704-1,938	.21						
Jan. 14	954		1,166	2.17						
Jan. 15	526-863	.56	1,351		2,489	.31				
Jan. 16			1,753		2,226	.72				
Jan. 17	781		1,034	1.18						
Jan. 18	956		1,137	3.53						
Jan. 20	526-768	2.81	1,327-1,455	2.74						
Jan. 23	851-991	.86								
Jan. 24			1,027-1,190	2.64						
Jan. 25	920		1,149	.50						
Jan. 28	883		1,398	.43						
Jan. 29			1,239-1,723	.97						
Jan. 30	778		1,082	2.37						
Jan. 31	526		1,676	.88						
Feb. 1	526-847	.09								
Feb. 3			1,633-1,771*	.43						
Feb. 4			1,159-1,261	4.80						
Feb. 5	526		1,854	0.77						
Feb. 6	526-878	.88								
Feb. 7			1,310-1,500	1.26						
Feb. 8	940		1,742	1.06						
Feb. 10	526		1,575	1.05						
Feb. 11	526		1,161	.53						
Feb. 12	526-881	1.44			2,642-2,957	2.07				
Feb. 13	526		1,027	1.58						
Feb. 14	526-878	3.00								
Feb. 15	898		1,122	1.20						
Feb. 17					2,360		3,062	.24		
Feb. 18			1,225-1,613*	.91						
Feb. 19	526		1,279	.25						
Feb. 20			1,248-1,533	1.65						
Feb. 21	526		1,087	1.09						
Feb. 22					2,015-2,117	3.14				
Feb. 25	863		1,896	.70						
Feb. 26			1,499-1,768	.52						
Feb. 27			1,086-1,324	.29						
Mar. 2	526-881	.17	1,804		2,065	.46				
Mar. 3			1,111-1,498	1.55						
Mar. 5	526-856	.88			2,620-2,784*	.06				
Mar. 6	526		1,238	1.94	1,845-2,196*	.85				
Mar. 7			1,916		2,458*	.24				
Mar. 9			1,194-1,996	.47						
Mar. 10			1,202-1,456	1.61	2,108-2,262	.57				
Mar. 11					2,057-2,247*	.68				
Mar. 12			1,659-1,740	2.22						
Mar. 14	947		1,189	1.69						
Mar. 17	526		1,242	.88						
Mar. 18	819		1,204	1.69						
Mar. 19	526-816	.28	1,347-1,845	.50						
Mar. 20			1,498-1,693	1.28						
Mar. 21			1,069-1,308	1.17						
Mar. 23	526-848	.47								
Mar. 26	526		1,209	1.43						
Mar. 27					2,544-2,633	.90				
Mar. 28	526-896	1.35								
Mar. 31	526		1,030	1.53						

* Highest point of flight. † May have been due to cloud.

THE CHANGE OF PHASE DUE TO THE PASSAGE OF ELECTRIC WAVES THRU THIN PLATES AND THE INDEX OF REFRACTION OF WATER FOR SUCH WAVES, WITH APPLICATIONS TO THE OPTICS OF THIN FILMS AND PRISMS.

By W. R. Blair.

Part II.

The subject of refraction and reflection of light at the boundary plane between two transparent substances having different indices of refraction has been simply treated by Stokes, who used the principle of reversibility, and more elaborately by Fresnel, who follows the changes undergone by the components of the amplitude in and perpendicular to the plane of incidence. Fresnel's value for that component of the amplitude of the reflected ray which is normal to the plane of incidence is given by

$$R_n = -A_n \frac{\sin (i-r)}{\sin (i+r)}$$

and for the component in the plane of incidence

$$R_p = A_p \frac{\tan (i-r)}{\tan (i+r)}$$

where A_n and A_p are the amplitudes of the respective components of the incident ray and i and r are the angles of incidence and refraction. i and r are connected by the relation,

$$\sin i = n \sin r,$$

n being the index of refraction between the two media which, in this discussion, is taken so that its value is greater than 1. If i and r are sufficiently small angles their sines may be replaced by nr and r and their cosines by 1. Making these changes in the formula gives

$$R_n = -A_n \frac{n-1}{n+1}$$

and

$$R_p = A_p \frac{n-1}{n+1},$$

the values of the amplitudes of the two components for perpendicular incidence.

If the angles r and i are interchanged in these equations, R_n and R_p change sign but not numerical value, indicating, as does Stokes's

treatment of the subject, that, on reversal of the ray, the same fraction of the light is reflected; but that, if in either case there is no change of phase at reflection, in the other there is a change of phase of π. Fresnel's equations further show on which side of the boundary plane this change of phase occurs for given values of i and n. That R_n is always negative for $n>1$ shows a change of phase of π in this component of the reflected ray for all angles of incidence; that R_p is positive taken together with its reversal of direction shows the same thing for values of i and n such that $i+r<\pi/2$. At $i+r=\pi/2$, the sign of R_p changes, indicating no change of phase in the reflected ray for $i+r>\pi/2$. It follows that were light incident upon the other side of the boundary plane at such angles that $i+r>\pi/2$, there would be a change of phase of π in that component of the reflected ray lying in the plane of incidence. The squares of R_n and R_p give the intensities of these components at whatever value of i and their sum is the intensity of the reflected ray, while, in accord with the principle of the conservation of energy, the intensity of the light less this sum is the intensity of the light passing thru the boundary plane. For values of n large, if n be taken so that it is greater than 1, or small, if taken the other way, the amount of light reflected at the boundary plane is large while the amount transmitted is small and vice versa.

Fresnel's equations have been tested by experiment and very closely represent observed facts. The largest disagreement of observation with theory occurs at the polarizing angle. The change of phase here is not abrupt as the theory indicates, but, while sharp, is continuous, especially if substances having high indices of refraction be used. Surface films have been shown to account in part but not altogether for the disagreement. In testing these formulas light rays have been used almost altogether. However, assuming their validity for electric waves of 5 centimeters in length, Mr. Cole has obtained apparently good values for the indices of refraction of water and alcohol, measurements being made of the energy reflected from the surfaces of these liquids.

Using the above well known facts, it is proposed to explain the experimentally determined phase curve described in Part I, of this paper, and related phenomena. The curves of transmission and reflection mentioned in Part I, are incidentally explained.

Fig. 10 represents a cross-section of a film of variable thickness z and having a specific inductive capacity K_2. It is bounded above and below by dielectrics having specific inductive capacities K_1 and K_3 as shown. K_3 is put into the formula because it nearly always happens that the thin film must be supported by a plate of some other dielec-

tric, which influences considerably the internal reflection of the film. The problem is to determine the phase and intensity of the light transmitted by such a film compared with that incident upon its upper surface. Since if there is a change of phase accompanying internal reflection at the boundary planes of this film, it is equal to π, and since, in considering the effect of multiple internal reflections upon either the reflected or transmitted light, two such reflections always occur between the passages of light thru a given boundary plane, the

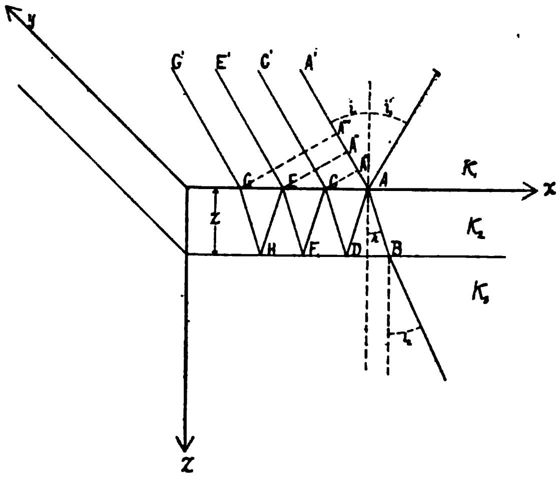

FIG. 10.

total change of phase, not depending on z, occurring before the reflected ray returns to the boundary plane in question, is either 2π or zero, and no account need be taken of it in this discussion. For this and the further reason that in order to apply Fresnel's equations the amplitude of the incident ray must be resolved into its components in and perpendicular to the plane of incidence, there is no loss of generality in what follows if we consider a simple electromagnetic disturbance of the form,

$$S = A \sin\left(2\pi \frac{t}{T} \pm \delta\right)$$

in either of these planes incident at A. No account need be taken of which of the two planes the disturbance is in and the formulas deduced will be subject to treatment by either the equation for R_n or for R_p, such treatment however giving results peculiar to the plane of the polarized ray, of which the plane of vibration is indicated by the subscript in the equation used.

Let a be the amplitude of the ray incident at A, then ae will be the amplitude of the reflected ray at A and $a\,(1-e_1^2)^{\frac{1}{2}}$, the amplitude of the refracted ray, where e_1 is a fraction of value depending on K_1 and K_2. Now if a^2 be the coefficient of transmission and τ the distance $AB=z/\cos r$ thru the film of thickness z measured in wave-lengths in the film, then $aa^\tau(1-e_1^2)^{\frac{1}{2}}$ will be the amplitude of the ray under consideration when it reaches B, and $aa^\tau(1-e_1^2)^{\frac{1}{2}}\,(1-e_2^2)^{\frac{1}{2}}$, the amplitude of the refracted rays at B. Superposed upon this will be rays of amplitudes,

$$aa^{3\tau}e_1 e_2 (1-e_1^2)^{\frac{1}{2}}\,(1-e_2^2)^{\frac{1}{2}}\,,\ aa^{5\tau}e_1^2 e_2^2\,(1-e_1^2)^{\frac{1}{2}}\,(1-e_2^2)^{\frac{1}{2}}\,,$$

etc., due to rays incident on the upper surface at C, E, etc.; e_2 is a fraction of value depending on K_2 and K_3. If the disturbance incident at A be represented by $S_1'=a\sin 2\pi\,t/T$, that incident at C will be represented by $S_2'=a\sin 2\pi\,(t/T+2\tau\sin^2 r)$, at E by $S_3'=a\sin 2\pi\,(t/T+4\tau\sin^2 r)$, etc., $2\tau\sin^2 r$ being the distance AA'' in the unit above chosen. It follows, therefore, that the ray BB' is given by

$$S_t=a_t'\left\{\sin 2\pi\left(\frac{t}{T}-\tau\right)+a^{2\tau}\sin 2\pi\left(\frac{t}{T}-[3\tau-2\tau\sin^2 r]\right)\right.$$
$$\left.+\,a^{4\tau}e_1^2\,e_2^2\sin 2\pi\left(\frac{t}{T}-[5\tau-4\tau\sin^2 r]\right)+\ \ldots\right\}=A_t\sin\left(\frac{2\pi t}{T}-\delta_t\right),$$

in which

$$A_t\cos\delta_t=a_t'\,\{\cos\theta+a^{2\tau}e_1 e_2\cos(3\theta-2\varphi)+a^{4\tau}e_1^2\,e_2^2\cos(5\theta-4\varphi)+\ldots\}$$

and

$$A_t\sin\delta_t=a_t'\}\sin\theta+a^{2\tau}e_1\,e_2\sin(3\theta-2\varphi)+a^{4\tau}e_1^2\,e_2^2\sin(5\theta-4\varphi)+\ldots\}$$

where $\qquad a_t'=aa^\tau\,(1-e_1^2)^{\frac{1}{2}}\,(2-e_2^2)^{\frac{1}{2}}\,,\ \theta=2\pi\tau,$

and $\qquad \varphi=2\pi\tau\sin^2 r.$

To sum these series, substitute in the equation,

$$\frac{1}{1-x}=1+x+x^2+x^3+\ldots,$$

$$x=a^{2\tau}e_1\,e_2\,\{\cos\delta\,(\theta-\varphi)+i\sin(\theta-\varphi\}$$

and multiply both members by $a_t\,(\cos+i\sin\theta)$; equate the real numbers in one member to those in the other and similarly for the imaginaries; simplify and get

$$A_t\cos\delta_t=\frac{a_t'\,[\cos\theta-a^{2\tau}e_1e_2\cos(\theta-2\varphi)]}{1-2ae_1e^{2\tau}{}_2\cos 2\,(\theta-\varphi)+a^{4\tau}e_1^2e_2^2}\,,$$

$$A_t\sin\delta_t=\frac{a_t'\,[\sin\theta-a^{2\tau}e_1e_2\sin(\theta-2\varphi)]}{1-2a^{2\tau}e_1e_2\cos 2\,(\theta-\varphi)+a^{4\tau}e_1^2e_2^2}\,,$$

I. $$\tan\delta_t=\frac{\sin\theta+a^{2\tau}e_1e_2\sin(\theta-2\varphi)}{\cos\theta+a^{2\tau}e_1e_2\cos(\theta-2\varphi)}\,,$$

II. $$A_t^2=\frac{(a_t')^2}{1-2a^{2\tau}e_1e_2\cos 2\,(\theta-\varphi)+a^{4\tau}e_1^2e_2^2}\,.$$

Making a similar calculation of the phase change and intensity of reflected light, remembering that there is a difference of phase of π between externally and internally reflected rays, gives

$$A_r \cos \delta_r = a_r' \frac{\cos 2(\theta-\varphi) - a^{2\tau} e_1 e_2}{1-2a^{2\tau} e_1 e_2 \cos 2(\theta-\varphi) + a^{4\tau} e_1^2 e_2^2} - ae_1,$$

$$A_r \sin \delta_r = a_r' \frac{\sin 2(\theta-\varphi)}{1-2a^{2\tau} e_1 e_2 \cos 2(\theta-\varphi) + a^{4\tau} e_1^2 e_2^2},$$

III. $$\cot \delta_r + \frac{ae_1}{A_r} \csc \delta_r = \frac{\cos 2(\theta-\varphi) - a^{2\tau} e_1 e_2}{\sin 2(\theta-\varphi)},$$

IV. $$A_r^2 = \frac{(a_r')^2 - 2aa_r' e_1 [\cos 2(\theta-\varphi) - a^{2\tau} e_1 e_2]}{1-2a^{2\tau} e_1 e_2 \cos 2(\theta-\varphi) + a^{4\tau} e_1^2 e_2^2} - a^2 e_1^2,$$

where $a_r' = aa^{2\tau} e_2 (1-e_1^2)$.

As was to be expected, if a be put equal to one, i. e., if there be no absorption of radiation by the film,

$$A_t'^2 + A_r'^2 = a^2.$$

This check upon the work together with the fact that the formula A_t^2 and A_r^2 appear in the proper form for direct application to the experimental data is considered justification for deducing them here along with those for δ_t and δ_r altho, in slightly differing forms, they will be found, as noted in (I) of the summary of Part I., in the texts on optics.

The above formulas are quite general and simplify considerably under reduction to special cases. As they stand, however, data could be obtained for the determination of A_t and δ_t, if the transparent film upon which measurements are to be made were introduced in front of one of the plane mirrors of an interferometer in such a way that the angle of incidence could be varied. A series of dielectrics could be used to give different values of n. The thickness of the film must always be known and for a given dielectric could be varied. The smaller the absorption coefficient the thicker the films from which measurable effects may be obtained. Such an experiment is practicable if one uses electric waves of convenient length, but the construction of sufficiently thin uniform films for use with light waves and, since the usual optical methods are not available, the measurement of their thickness, makes the problem a difficult one. One method which suggests itself is the construction of one sufficiently thin, uniform film upon which measurements may be taken with different wave-lengths. This film need not be large in extent and may be made from some metal, better from a more transparent substance, having as high an index of refraction as possible, the thickness to be determined by the

optical method after a suitable wave-length or lengths have been found. Another method is to make three measurements on a given film of either δ_t or δ_r for different angles of incidence; substitute in the proper formula and solve simultaneously for n, z, a. An arrangement of this sort, shown in fig. 11, could be used in the determination of A_r and δ_r. S is the source of radiation, C the collimator, F the film, T the telescope or receiver, and A a device for varying the angle of incidence.

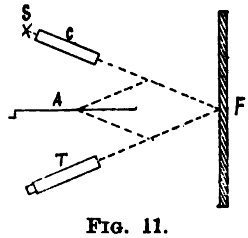

FIG. 11.

For the case covered by the experiment in Part I, i. e., that of perpendicular incidence,

$$\tan \delta_t = \frac{1+a^{2z} e_1 e_2}{1-a^{2z} e_1 e_2} \tan 2\pi z,$$

$$A_t^2 = a^2 \frac{a^{2z}(1-e_1^2)(1-e_2^2)}{1-2a^{2z} e_1 e_2 \cos 4\pi z + a^{4z} e_1^2 e_2^2}.$$

TABLE 3.

z (in λ's).	θ (in π).	δ_t (in π).	p (calc.).	z (in mm.).	p (obs.).
$\frac{1}{32}$	.0625	.1436	19.49	1	16.00
$\frac{1}{16}$	.1250	.2474	16.65	2	16.20
$\frac{3}{32}$	.1875	.3144	13.96	3	13.40
$\frac{1}{8}$	.2500	.3640	12.00	4	9.10
$\frac{3}{16}$	.3750	.4370	9.40	5	8.20
$\frac{1}{4}$	.5000	.5000	7.92	6	7.20
$\frac{5}{16}$	.6250	.5698	7.13	7	6.14
$\frac{3}{8}$	.7500	.6633	6.89	8	6.62
$\frac{7}{16}$	.8750	.8046	7.20	9	7.10
$\frac{1}{2}$	1.0000	1.0000	7.92	10	7.62
$\frac{9}{16}$	1.1250	1.1843	8.39	11	8.14
$\frac{5}{8}$	1.2500	1.3154	8.39	12	8.33
$\frac{11}{16}$	1.3750	1.4182	8.17	13	8.60
$\frac{3}{4}$	1.5000	1.5000	7.92	14	8.60
$\frac{13}{16}$	1.6250	1.5915	7.74	15	8.10
$\frac{7}{8}$	1.7500	1.7009	7.67	16	7.87
$\frac{15}{16}$	1.8750	1.8889	7.75	17	7.82
1	2.0000	2.0000	7.92	18	7.69
				19	7.68
				20	7.72
				21	7.85
				22	8.10

Since δ_t is the total change of phase due to the film of thickness z and $2\pi z/n$ (z is measured in wave-lengths in the film) the change of phase which would occur if the film were removed, the net change of phase Δ_t, is given by

V. $$\Delta_t = \delta_t - \frac{2\pi z}{n}$$

and

VI. $$\frac{n\Delta_t}{2\pi z} = \frac{n\delta_t}{2\pi z} - 1 = p,$$

where p is the change of phase per unit thickness of the film as measured experimentally.

From Fresnel's formulas,

$$e_1 = \frac{n_1 - 1}{n_1 + 1}$$

$$e_2 = \frac{n_2 - 1}{n_2 + 1}$$

where n_1 is the index of refraction of water with reference to air, 8.92, and n_2 is the index of water with reference to glass, 3.38; 2.64 is taken as the index of refraction of glass. Evaluting these gives

$$e_1 = .798,$$

$$e_2 = .543.$$

A computation of a^2 from selected ordinates of the phase curve gives a value of about .31, which indicates that over 60 per cent of the

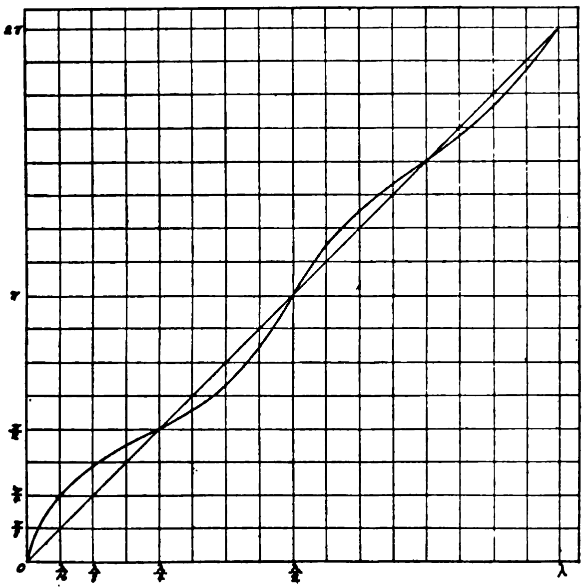

FIG. 12.

energy of radiation is absorbed by one wave-length, 21.2 mm., thickness of water.

Table 3 shows the value of δ_t and p as calculated from the formulas up to $z=1$ and, for comparison, the observed values of p. The curve shown in fig. 12 is the graph of δ_t, the diagonal giving the values of θ. Fig. 13 shows the observed and calculated values of p. Observed values are marked ⊙, calculated, ×. The agreement is good with the exception of the third, seventh, and fourteenth points. It is evident that the departure of the curve in fig. 12 from the straight line, $\theta = 2\pi z$, depends on $e_1 e_2$ unless the coefficient of transmission be much

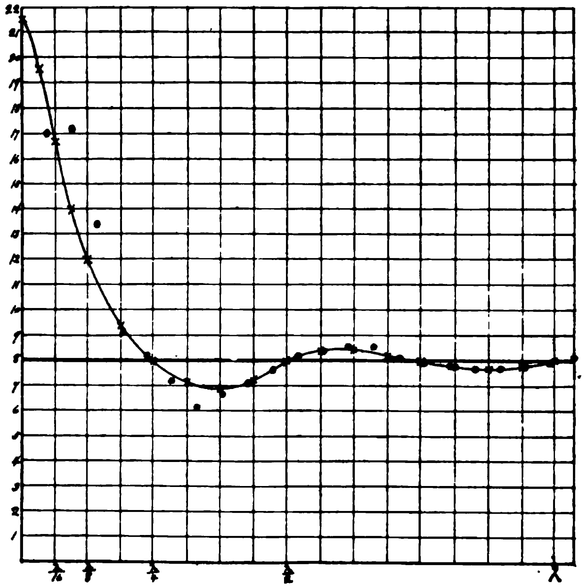

FIG 13.

less than one. This departure is considerable even with low indices of refraction, as will be seen from the application of the formulas I, V, and VI, to the experiment on the paraffin plates described in Part 1.

Take 1.47 as the index of refraction of paraffin and assume the coefficient of transmission to be 1. There can be little error in this assumption, even tho a^2 be considerably less than 1, since the plates used range from $\frac{1}{20}$ to $\frac{1}{12}$ of a wave-length in thickness. Formula I becomes

$$\tan \delta_t = \frac{1.0362}{.9638} \tan 2\pi z$$

and the mean index of refraction for plates of the above thickness computed by V and VI is

$$n=1.565,$$

an increase of almost $6\frac{1}{2}$ per cent over 1.47. The block of paraffin has

a thickness of $\frac{3}{4}$ of a wave-length. Applying the formula to this thickness gives the index to be

$$n = 1.484$$

or nearly 1 per cent over 1.47.

While the results of this experiment on the paraffin plates did not at the time, August, 1906, seem to justify the assertion that the differences in the different determinations of the index of refraction were due to a change of phase not a linear function of the thickness of the plate, these theoretical considerations appear to show that such was the case.

The application of the above formulas being fairly well justified by experiment, may further be made to the work of Johonnott[9] and others on the thickness of thin liquid films. For an index of 1.33, neglecting the coefficient of transmission and assuming perpendicular incidence, formula I becomes approximately

$$\tan \delta_t = \frac{1.02}{.98} \tan 2\pi z.$$

Recomputing from Johonnott's data in a case in which he gets $z\lambda =$ 12.6 $\mu\mu$, and taking the phase change into consideration gives $z\lambda = 12.1$ $\mu\mu$, the difference being about 4 per cent. The mean of 12 $\mu\mu$ as limiting thickness of the first black becomes 11.5 $\mu\mu$.

It is probable that this correction just accounts for the difference in the two values found by Reinold and Rücker[10] for this same quantity and justifies the latter of the following assumptions. They used two methods in their determinations: an optical method based upon the assumption that the index of refraction as computed by the usual formulas is the same for any thickness of plate and an electrical method underlying which was a similar assumption with reference to the resistance of a liquid. By the first method they obtain 11.8 $\mu\mu$, by the second 11.3 $\mu\mu$.

The spectrometer experiment described in Part I was intended to serve as a check on the work with the interferometer. While it serves this purpose well, the formulas used in the interpretation of the results with thin plates can not, except in a general way, be used to account for the results with the thin prism.

Fig. 14 shows a section of the prism and the paths of the rays thru it. This figure illustrates the special case in which incidence is perpendicular, ψ is .83° and n is 8.92. The consideration of the general case has not been found profitable on account of the comparatively complicated expressions which arise, and its limited application to special cases. The angle of incidence r_1 of the ray AB on the second

face at B is ψ. Its angle of refraction i_1 is $7^\circ+25'$. For the ray CB, r_2 is 3ψ, i_2 is $22^\circ+48'$; for DB, r_3 is 5ψ and i_3 is $40^\circ+12'$; for EB, r_4 is 7ψ and i_4 is $64^\circ+40'$. Total reflection takes place at $7\frac{3}{4}\psi$. i_3 i_4 are

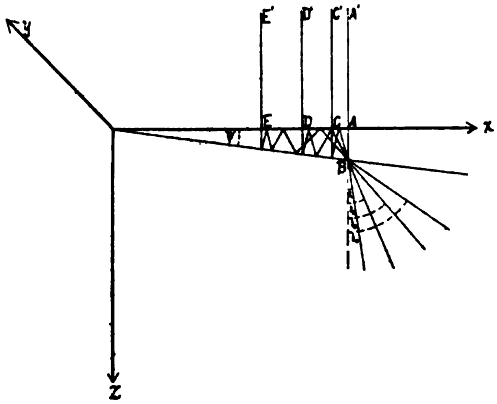

Fig. 14.

so large that the refracted parts of DB and EB could not enter the focusing cylinder at the same time as the refracted parts of AB and CB provided the cylinder be at the position for the maximum effect of the radiation upon the receiver as determined by the experiment. The rays AB and CB are therefore the only ones to be considered. It is clear that a circular cylinder of appropriate curvature would have given a better focus of the diverging rays and consequently a better defined maximum than that given by the parabolic cylinder used.

The resulting disturbance at B due to AB and CB is given approximately by

$$\begin{aligned} S &= s_1+s_2 \\ &= A\sin\left(2\pi\frac{t}{T}-\delta\right) \\ &= .3614aa^{x\tan\psi}\sin 2\pi\left(\frac{t}{T}-x\tan\psi\right) \\ &\quad + .226aa^{3x\tan\psi}\sin 2\pi\left(\frac{t}{T}-3x\tan\psi\right) \end{aligned}$$

where a is the amplitude of the rays incident at A and a^1, the coefficient of transmission. Fresnel's formulas are again used in getting values of e; x is measured in wave-lengths in water. Putting θ for $2\pi x\tan\psi$ and solving gives

$$\tan\delta = \frac{1.6+3a^\tau-4a^\tau\sin^2\theta}{1.6-3a^\tau+4a^\tau\cos^2\theta}\tan\theta.$$

Table 4 gives a few of the values of τ, θ, and δ for comparison.

TABLE 4.

τ (in λ's).	θ (in π).	(n π).	τ (in λ's).	θ (in π).	δ (in π).
$\frac{1}{32}$	.0625	.1098	$\frac{7}{16}$	.8750	.8098
$\frac{3}{32}$	.1875	.3157	$\frac{1}{2}$	1.0000	1.0000
$\frac{1}{8}$	.2500	.4076	$\frac{9}{16}$	1.1250	1.1836
$\frac{3}{16}$	.3750	.4650	$\frac{5}{8}$	1.2500	1.3430
$\frac{1}{4}$	.5000	.5000	$\frac{11}{16}$	1.3750	1.4688
$\frac{5}{16}$	.6250	.5075	$\frac{3}{4}$	1.5000	1.5000
$\frac{3}{8}$	.7500	.6281	$\frac{13}{16}$	1.6250	1.5604

Fig. 15 is a graph of these values and makes apparent the reason for the different angles of deviation found for different parts of the same prism. The values of δ are marked $\odot$. They have a somewhat similar relation to θ as that shown in fig. 12, values of θ being given by the diagonal straight line. A computation of D, the angle of deviation, for that part of the prism from $\frac{1}{8}\lambda$ to $\frac{5}{16}\lambda$ in thickness gives

$$D = 1^\circ + 45.5'.$$

This value is 8.5′ less than the value observed for D at approximately this part of the prism. A similar computation gives

$$D = 8^\circ + 33'$$

for the part of the prism between $\frac{5}{16}\lambda$ and $\frac{11}{16}\lambda$ in thickness. This value

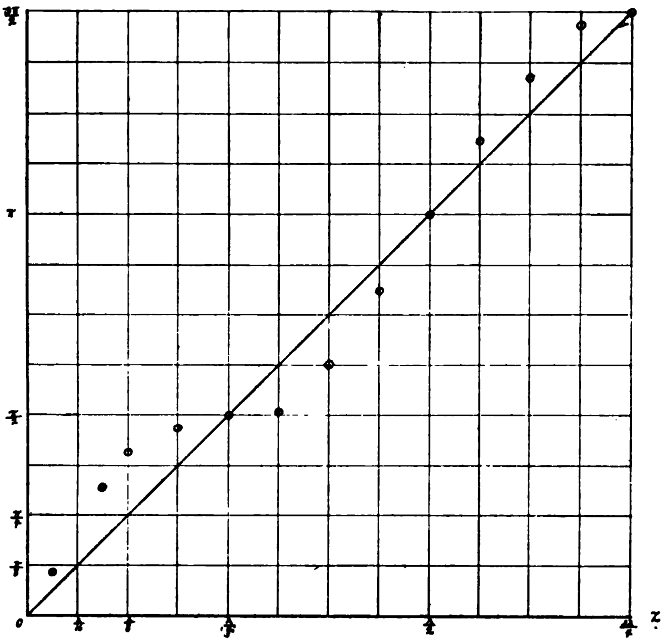

FIG. 15.

is 51′ greater than that observed for about the same part of the prism. Both experiment and calculation on the thin prism are somewhat rough

but of sufficient accuracy to show that, for a thin prism of material the index of refraction of which differs much from one in either direction, the angle of deviation is different for different parts of the prism and can not be used in the ordinary formulas for computing the index of refraction from data obtained by means of a spectrometer.

Fig. 16 shows the curve of transmission of energy as worked out from formula II for a thin film. This curve is below the observed curve. It has sharp maxima and broad minima compared with that in fig. 9, which taken with the curve in fig. 6 seems to indicate that the receiver responds to a limited group of wave-lengths in the vicinity of the one wave-length to which it is tuned. Further evidence is had in the fact that, when no water plate intervenes, the wave-length responded to by the receiver is quite uniformly 19.1 cm. in air, with the plate intervening, wave-lengths varying from this by several millimeters are obtained, as in the sample set of readings given in Part I. This disagreement between the curves in fig. 16 and fig. 9 is due no doubt to the fact that the curve in fig. 16 is computed for one wave-length only, while that in fig. 9 is the resultant effect of a limited group of wave-lengths. Where the plate is almost opaque to a given

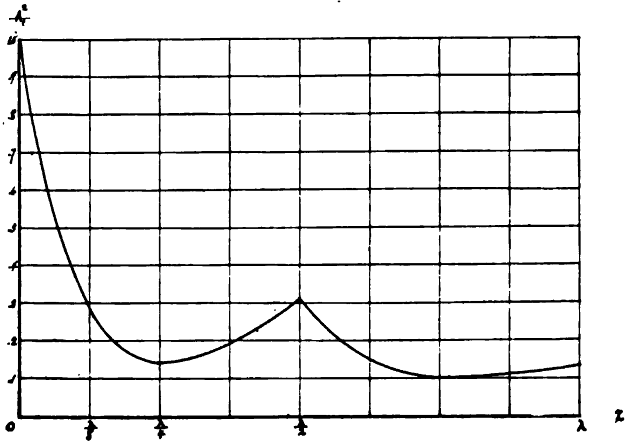

FIG. 16.

wave-length, it is transparent to others either longer or shorter. The pulse from the gap containing a given group of component wave-lengths has some of these lengths sorted out by the plate so that a slightly different group presents itself to the receiver at every thickness of the plate. The receiver, having been tuned to the original group, responds less energetically to the modified groups; this response being in the nature of a compromise between the wave-lengths

offered by a given group and the ability of the receiver to respond to them.

It follows that at any given thickness of plate certain wave-lengths, given by $\tau = (2n - 1)\lambda/4$ are partially taken out of the group, while others given by $\tau = n\lambda/2$ are more intense. For thin prisms, fig. 15 shows the same sort of selection. The prism becomes a sort of transmission grating. It is seen further that a prism having a given refracting angle and composed of material having a given index of refraction will produce for a given angle of incidence an angle of deviation depending upon the wave-length. Consider in fig. 15 the part of the prism between $z = \frac{5}{16}$ and $z = \frac{11}{16}$. For a given wave-length λ in the medium of the prism, the distance along the face of the prism will be d, for any other wave-length λ', the distance d' will be greater or less than λ depending on whether λ' is greater or less than λ, but the change in phase between these two thicknesses will be the same, since z is measured in wave-lengths in the prism. This means that for the shorter wave-lengths the virtual face of the prism will make a greater angle with the real face at that part of the prism where, for the wave-length under consideration, the transmitted light is most intense, with the result that the angle of deviation of the shorter wave-length will be greater. Lampa's[1] experiment on the index of refraction of water seems to support this conclusion. He used a prism having a refracting angle of 4° and found the angles of deviation for the three wave-lengths, 4, 6, and 8 mm. The groups of wave-lengths in which these predominated were probably quite limited. From these angles he computed, by the usual formula, the following values of the specific inductive capacity of water:

$$K_{(\lambda=4)} = 90.2,$$
$$K_{(\lambda=6)} = 88.4,$$
$$K_{(\lambda=8)} = 80.4,$$

Prof. A. Kundt[4], in his experiments on thin metallic prisms, made two measurements on each prism. (1) Its refracting angle. This was measured by the reflection from the face of the prism. If we may judge from formula III, above, the angle thus obtained can not be taken as the actual refracting angle. (2) The angle of deviation. As has been shown in the case of the water prism, this angle is dependent on the thickness of that part of the prism thru which the light is transmitted as well as upon the refracting angle, the index of refraction and the wave-length. No observation was made from which the thickness of the prism at the part in question can be determined, consequently a simultaneous computation, assuming the

above formulas to hold for metals, of the actual angles of refraction and deviation is impossible.

At what refracting angle the virtual face of the prism coincides with the real face must be somewhat dependent upon the adjustment of the other parts of the spectrometer and is a subject for further experiment. A theoretically correct method of determining the index of refraction of a material for a given wave-length λ, is to use a plane parallel plate of it of thickness $n\lambda/2$ and measure the retardation of the light due to its passage thru this plate. n is a whole number and λ is the wave-length in the material used. Practically, n need not be a whole number if the plate be thick when measured in wave-lengths.

To the summary given in Part I may now be added:

5. The variable change of phase observed in the experiments with thin films and prisms, also the variation in intensity of the transmitted and reflected energy are interference phenomena, and are due to the superposition of the successive transmissions or reflections arising from multiple internal reflection.

6. The text-book formulas used for computing the index of refraction of a substance from data taken with either the interferometer or the spectrometer will not apply in the cases of thin films and thin prisms, but must be supplemented by the formulas given above.

7. The virtual face of a thin prism is not coincident with its real face, but, for a given wave-length in the medium of the prism, a section perpendicular to the edge shows a somewhat sinusoidal curve which cuts the real face at those points where the thickness of the prism is $n\lambda/4$. Its slope is least at the points $(2n-1)\lambda/4$, greatest at $n\lambda/2$, these slopes being steeper for wave-lengths shorter than λ and less steep for those longer. The transmitted energy is least at $(2n-1)\lambda/4$, greatest at $n\lambda/2$, and is always dependent on the index of refraction. The thin prism is thus a transmission grating possest of properties by which, to a certain extent, it accomplishes the analysis and dispersion of white light.

For their helpful crticism of his work and the suggestions above mentioned, the author takes this opportunity of expressing his appreciation to Professors Michelson and Millikan.

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UPPER AIR TEMPERATURES FOR JANUARY, FEBRUARY, AND MARCH.

By the Aerial Section—W. R. BLAIR in charge.

The following charts and tables are constructed as described in previous numbers of the Bulletin, and show upper air temperatures for January, February, and March.

The mean of the highest altitudes reached daily in January is 9,925 feet (3,034 meters), and in the three months, January, February, and March, 9,096 feet (2,773 meters), while the highest altitude reached is 19,102 feet (5,822 meters).

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. / 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.					*Miles*	*Met's*							*Miles*	*Met's*
Jan. 1:	° *F.*	° *C.*	%		*p. h.*	*p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	%		*p. h.*	*p. s.*
7:07 a. m.	38.7	3.7	29	sw.	10	4.5	1,725	526	38.7	3.7	29	sw.	10	4.5
7:17 a. m.	39.0	3.9	29	sw.	10	4.5	2,874	876	37.4	3.0	....	sw.	......	......
7:26 a. m.	39.0	3.9	29	sw.	10	4.5	3,975	1,212	32.2	0.1	....	w.	......	......
7:38 a. m.	39.0	3.9	29	sw.	10	4.5	6,740	2,054	25.5	−3.6	....	w.	......	......
7:57 a. m.	41.2	5.1	25	sw.	12	5.4	7,762	2,366	22.6	−5.2	....	w.	......	......
8:18 a. m.	39.3	4.1	32	sw.	12	5.4	8,995	2,742	23.2	−4.9	....	w.	......	......
8:32 a. m.	39.6	4.2	32	sw.	12	5.4	7,512	2,290	27.1	−2.7	....	w.	......	......
9:12 a. m.	40.8	4.9	33	sw.	12	5.4	6,238	1,901	23.5	−4.7	....	w.	......	......
9:37 a. m.	41.3	5.2	29	sw.	12	5.4	3,682	1,122	32.7	0.4	....	w.	......	......
9:46 a. m.	41.4	5.2	30	sw.	12	5.4	1,725	526	41.4	5.2	30	sw.	12	5.4
Jan. 2:														
3:36 p. m.	42.8	6.0	36	wnw.	15	6.7	1,725	526	42.8	6.0	36	wnw.	15	6.7
3:46 p. m.	42.7	5.9	35	wnw.	18	8.0	3,960	1,207	30.9	−0.6	....	wnw.	......	......
3:56 p. m.	42.6	5.9	35	wnw.	17	7.6	5,174	1,577	25.5	−3.6	....	wnw.	......	......
4:05 p. m.	42.4	5.8	34	wnw.	15	6.7	7,208	2,197	19.0	−7.2	....	wnw.	......	......
4:14 p. m	42.0	5.6	35	wnw.	15	6.7	7,128	2,478	14.0	−10.0	....	wnw.	......	......
4:27 p. m.	41.2	5.1	34	wnw.	17	7.6	11,307	3,446	5.9	−14.5	....	wnw.	......	......
4:48 p. m.	40.0	4.4	31	nw.	16	7.2	14,654	4,467	−7.6	−22.0	....	wnw.	......	......
5:08 p. m.	39.2	4.0	33	nw.	14	6.8	16,917	5,156	−18.2	−27.9	....	wnw.	......	......
6:45 p. m.	38.0	3.3	28	nw.	16	7.2	15,050	4,587	−11.6	−24.2	....	wnw.	......	......
7:28 p. m.	37.7	3.2	27	nw.	17	7.6	12,295	3,748	1.0	−17.2	....	wnw.	......	......
8:31 p. m	34.0	1.1	40	nnw.	12	5.4	9,165	2,793	10.0	−12.2	....	wnw.	......	......
8:39 p. m	33.5	0.8	40	nnw.	10	4.5	8,624	2,629	10.4	−12.0	....	wnw.	......	......
8:54 p. m.	33.0	0.6	39	n.	12	5.4	6,924	2,111	15.6	−9.1	....	wnw.	......	......
9:02 p. m.	33.0	0.6	39	n.	12	5.4	6,267	1,910	17.6	−8.0	....	wnw.	......	......
9:16 p. m.	33.0	0.6	39	n.	12	5.4	3,716	1,133	26.6	−3.0	....	wnw.	......	......
9:27 p. m.	33.3	0.7	39	n.	12	5.4	1,725	526	33.3	0.7	39	n.	12	5.4

January 1, 1908.—Two kites were used; lifting surface, 142 sq. ft. (13.1 sq. m.). Wire out, 18,500 ft. (5,639 m.); at maximum altitude, 18,000 ft. (5,486 m.).

The sky was nearly covered with St.-Cu. and a small proportion of A.-Cu. at the beginning of the flight. After 8 a. m. the sky was overcast, at first with St., with St.-Cu. at 8:30 a. m., and again with St. by 9:50 a. m. All clouds were moving from the west.

Pressure was high over the South Atlantic States. A trough of low pressure extended from the lower St. Lawrence Valley to Oklahoma.

January 2, 1908.—Five kites were used; lifting surface, 345 sq. ft. (32.0 sq. m.). Wire out, 35,300 ft. (10,760 m.) at the maximum altitude.

The sky was cloudless.

At 8 a. m. a high, central over Colorado, extended over the greater part of the United States. Low pressure was central over Nova Scotia.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Jan. 3:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:54 a. m.	26.0	— 3.3	57	nw.	9	4.0	1,725	526	26.0	— 3.3	57	nw.	9	4.0
8:27 a. m.	27.0	— 2.8	57	nnw.	11	4.9	2,881	879	25.9	— 3.4	....	wnw.	......	.....
8:37 a. m.	26.8	— 2.9	59	nnw.	10	4.5	3,718	1,133	21.6	— 5.8	....	wnw.	......	......
8:54 a. m.	27.0	— 2.8	59	nnw.	11	4.9	5,143	1,568	18.5	— 7.5	....	nnw.	......	......
10:25 a. m.	28.0	— 2.2	65	nnw.	14	6.3	6,510	1,984	16.5	— 8.6	...	nnw.	......	......
10:46 a. m.	29.2	— 1.6	67	nnw.	14	6.3	4,940	1,507	18.5	— 7.5	....	nnw.	......	......
11:33 a. m.	29.5	— 1.4	59	nnw.	13	5.8	3,660	1,116	20.8	— 6.2	....	nw.	......	......
11:50 a. m.	29.9	— 1.2	59	nnw.	12	5.4	1,725	526	29.9	— 1.2	59	nnw.	12	5.4
2d flight.														
12:10 p. m.	30.8	— 0.7	61	nnw.	11	4.9	1,725	526	30.8	— 0.7	61	nnw.	11	4.9
12:50 p. m.	31.3	— 0.4	60	n.	10	4.5	2,646	806	26.8	— 2.9	....	nnw.	......	......
12:53 p. m.	31.3	— 0.4	60	n.	10	4.5	3,577	1,090	21.6	— 5.8	....	nnw.	......	......
1:07 p. m.	32.0	0.0	60	n.	10	4.5	5,080	1,548	16.7	— 8.5	....	nw.	......	......
1:10 p. m.	31.8	— 0.1	59	n.	12	5.4	5,642	1,720	20.3	— 6.5	....	nw.	......	......
1:29 p. m.	32.1	0.1	58	n.	11	4.9	6,459	1,969	19.6	— 6.9	...	nw.	......	......
1:47 p. m.	32.4	0.2	58	n.	11	4.9	6,415	2,481	19.4	— 7.0	....	nw.	......	......
2:56 p. m.	33.0	0.6	61	ne.	4	1.8	10,882	3,317	10.8	—11.8	....	nw.	......	......
3:42 p. m.	33.0	0.6	61	se.	4	1.8	13,676	4,168	1.6	—16.9	....	nw.	......	......
4:16 p. m.	33.0	0.6	61	se.	7	3.1	14,748	4,495	— 2.4	—19.1	....	nw.	......	......
5:34 p. m.	29.6	— 1.3	68	se.	6	2.7	13,638	4,163	3.2	—16.0	....	nw.	......	......
6:32 p. m.	29.0	— 1.7	67	se.	5	2.2	10,873	3,314	12.6	—10.8	....	nw.	......	......
6:59 p. m.	28.7	— 1.8	70	se.	5	2.2	5,662	1,726	23.9	— 4.5	....	w.	......	......
7:10 p. m.	28.7	— 1.8	70	se.	5	2.2	3,159	963	28.4	— 2.0	....	se.	......	......
7:13 p. m.	28.7	— 1.8	70	se.	5	2.2	1,725	526	28.7	— 1.8	70	se.	5	2.2
Jan. 4:														
7:48 a. m.	27.3	— 2.6	87	s.	15	6.7	1,725	526	27.3	— 2.6	87	s.	15	6.7
8:26 a. m.	27.6	— 2.4	87	s.	12	5.4	3,351	1,021	31.6	— 0.2	....	sw.	......	......
8:37 a. m.	28.3	— 2.1	88	s.	12	5.4	5,108	1,557	27.3	— 2.6	....	sw.	......	......
8:53 a. m.	29.5	— 1.4	87	s.	15	6.7	6,439	1,963	24.1	— 4.4	....	sw.	......	......
9:15 a. m.	29.0	— 1.7	85	s.	13	5.8	6,834	2,083	22.3	— 5.4	...	sw.	......	......
10:10 a. m.	28.0	— 2.2	92	se.	11	4.9	7,658	2,334	20.8	— 6.2	....	sw.	......	......
10:32 a. m.	27.8	— 2.3	90	se.	13	5.8	9,229	2,813	14.9	— 9.5	....	sw.	......	......
10:46 a. m.	27.8	— 2.3	90	se.	14	6.3	9,819	2,993	13.3	—10.4	....	sw.	......	......
10:51 a. m.	27.9	— 2.3	91	se.	14	6.3	8,016	2,443	18.7	— 7.4	....	sw.	......	......
11:00 a. m.	28.0	— 2.2	92	se.	14	6.3	6,871	2,094	21.9	— 5.6	....	sw.	......	......
11:10 a. m.	28.2	— 2.1	93	se.	14	6.3	5,190	1,582	29.5	— 1.4	....	sw.	......	......
11:20 a. m.	28.4	— 2.0	94	se.	16	7.2	4,256	1,297	30.4	— 0.9	....	sw.	......	......
12:03 p. m.	29.0	— 1.7	99	s.	15	6.7	2,778	847	32.0	0.0	...	ssw.	......	......
12:20 p. m.	29.0	— 1.7	100	s.	14	6.3	1,725	526	29.0	— 1.7	100	s.	14	6.3

January 3, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 16,500 ft. (5,029 m.) at the maximum altitude.

No clouds were observed.

High pressure, central over Kentucky, covered the eastern half of the country.

Second flight: Seven kites were used; lifting surface, 458 sq. ft. (42.3 sq. m.). Wire out, 35,300 ft. (10,760 m.); at maximum altitude, 33,500 ft. (10,211 m.).

Between 3 and 4 p. m. a few Ci. moving from the northwest formed and disappeared rapidly.

January 4, 1908.—Three kites were used; lifting surface, 216 sq. ft. (19.9 sq. m.). Wire out, 22,200 ft. (6,767 m.) at the maximum altitude.

Light snow fell during the flight, except from 9:10 to 9:30 a. m., from clouds moving from the south. The head kite was faintly visible up to about 7,000 ft. (2,134 m.). Dense fog set in just after the flight.

Pressure was high along the middle and south Atlantic coast, while low pressure was central over the Lakes.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet	Meters.	° F.	° C.	%		Miles p. h	Met's p. s.
Jan. 6:														
9:29 a. m.	25.0	− 3.9	75	sw.	10	4.5	1,725	526	25.0	− 3.9	75	sw.	10	4.5
10:07 a. m.	25.0	− 3.9	68	sw.	10	4.5	2,980	893	25.5	− 3.6	....	sw.	......	......
10:26 a. m.	24.7	− 4.1	67	sw.	10	4.5	3,046	928	27.3	− 2.6	....	wsw.	......	......
11:53 a. m.	29.6	− 1.3	68	se.	8	3.6	2,623	800	30.4	− 0.9	....	se.	......	......
1:05 p. m.	34.0	1.1	50	se.	10	4.5	1,725	526	34.0	1.1	50	se.	10	4.5
Jan. 7:														
2:20 p. m.	26.0	− 3.3	100	nnw.	25	11.2	1,725	526	26.0	− 3.3	100	nnw.	25	11.2
2:40 p. m.	26.5	− 3.1	100	nnw.	24	10.7	3,240	988	24.6	− 4.1	....	n.	......	......
3:08 p. m.	27.3	− 2.6	100	nnw.	24	10.7	3,010	918	27.9	− 2.3	....	n.	......	......
3:52 p. m.	27.6	− 2.4	100	n.	26	11.6	1,725	526	27.6	− 2.4	100	n.	26	11.6
Jan. 8:														
10:55 a. m.	32.2	0.1	60	w.	15	6.7	1,725	526	32.2	0.1	60	w.	15	6.7
11:08 a. m.	33.0	0.6	61	w.	13	5.8	2,938	896	29.8	− 1.2	....	wsw.	......	......
11:29 a. m.	33.8	1.0	62	sw.	14	6.3	3,767	1,148	25.5	− 3.6	....	w.	......	......
11:41 a. m.	34.0	1.1	62	sw.	14	6.3	4,637	1,413	21.6	− 5.8	....	w.	......	......
11:55 a. m.	34.2	1.2	62	sw.	16	7.2	5,297	1,614	23.4	− 4.8	....	w.	......	......
12:25 p. m.	34.6	1.4	64	sw.	12	5.4	6,723	2,049	17.6	− 8.0	....	wsw.	......	......
12:59 p. m.	35.7	2.1	64	sw.	12	5.4	8,193	2,497	11.8	−11.2	....	wsw.	......	......
1:58 p. m.	35.0	1.7	73	s.	4	1.8	9,770	2,978	4.5	−15.3	....	wsw.	......	......
2:26 p. m.	33.7	0.9	72	sw.	9	4.0	8,915	2,717	8.6	−13.0	....	wsw.	......	......
2:46 p. m.	33.6	0.9	72	sw.	9	4.0	7,094	2,162	10.8	−11.8	....	wsw.	......	......
3:11 p. m.	34.3	1.8	66	sw.	8	3.6	5,510	1,680	17.2	− 8.2	....	w.	......	......
3:29 p. m.	34.0	1.1	70	w.	11	4.9	2,805	855	28.0	− 2.2	....	w.	......	......
3:40 p. m.	34.1	1.2	67	w.	9	4.0	1,725	526	34.1	1.2	67	w.	9	4.0

January 6, 1908.—Two kites were used; lifting surface, 142 sq, ft. (13.1 sq. m.). Wire out, 2,900 ft. (884 m.); at maximum altitude, 2,500 ft. (762 m.).

At the beginning of the flight the sky was nearly covered with Ci. and A.-St. moving from the west. Cloudiness gradually diminished, and only a few clouds were to be seen at the end of the flight.

High pressure was central over eastern Maryland, while pressure was low north of Dakota and not so low over the northern Gulf.

January 7, 1908.—Two kites were used; lifting surface, 70 sq. ft. (6.3 sq. m.). Wire out, 4,000 ft. (1,219 m.) at the maximum altitude.

Dense fog, sleet, and snow prevailed during the flight. The wind velocity aloft was apparently very high.

At 8 a. m. a storm area was central over the North Carolina coast, and rain or snow was falling from Pennsylvania southward. Pressure was low also over Lake Superior, but increased thence to Nova Scotia.

January 8, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 19,550 ft. (5,959 m.); at maximum altitude, 18,100 ft. (5,517 m.).

At the beginning of the flight 4/10 upper and 3/10 lower clouds were moving from the west-southwest. About noon St.-Cu. began to move in from the west, the bases of some of the lower ones lying at an altitude of about 4,700 ft. (1,433m.). These clouds covered the sky after 2 p. m. In descending the kite emerged from the St.-Cu. clouds at an altitude of about 5,900 ft. (1,798 m.). The last 4,500 ft. (1,372 m.) of wire came in slightly coated with frost.

Low pressure covered the eastern United States, with a central depression of 28.75 inches over the lower St. Lawrence, and a secondary depression over Lake Erie.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
Jan. 9:														
9:33 a.m.	20.2	— 6.6	67	nw.	32	14.3	1,725	526	20.2	— 6.6	67	nw.	32	14.3
9:43 a.m.	20.0	— 6.7	66	nw.	34	15.2	2,783	848	13.5	—10.3	....	nw.	......	......
10:00 a.m.	19.0	— 6.7	66	nw.	33	14.8	3,525	1,074	9.9	—12.3	....	nw.	......	......
10:09 a.m.	19.9	— 6.7	66	nw.	35	15.6	4,346	1,325	5.9	—14.5	....	nw.	......	......
10:22 a.m.	20.0	— 6.7	65	nw.	36	16.1	5,353	1,632	3.9	—15.6	....	nw.	......	......
10:44 a.m.	19.2	— 7.1	69	nw.	38	17.0	6,220	1,896	2.7	—16.3	....	nw.	......	......
11:10 a.m.	18.9	— 7.3	69	nw.	38	17.0	5,219	1,591	7.0	—13.9	....	nw.	......	......
11:19 a.m.	19.0	— 7.2	69	nw.	37	16.5	4,677	1,426	3.7	-15.7	....	nw.	......	......
11:30 a.m.	19.0	— 7.2	69	nw.	36	16.1	4,440	1,353	3.7	—15.7	....	nw.	......	......
11:45 a.m.	19.1	— 7.2	60	nw.	39	17.4	2,867	874	11.5	—11.4	....	nw.	......	......
12:05 p.m.	19.0	— 7.2	59	nw.	36	16.1	1,725	526	19.0	— 7.2	59	nw.	36	16.1
Jan. 10:														
11:26 a.m.	19.8	— 6.8	70	se.	10	4.5	1,725	526	19.8	— 6.8	70	se.	10	4.5
11:30 a.m.	19.8	— 6.8	70	se.	10	4.5	2,632	802	24.8	— 4.0	....	s.	......	......
11:45 a.m.	19.8	— 6.8	72	se.	10	4.5	3,081	939	25.0	— 3.9	....	ssw.	......	......
12:00 m...	21.3	— 5.9	72	se.	10	4.5	4,641	1,415	23.7	— 4.6	....	sw.	......	......
12:30 p.m.	21.3	— 5.9	70	se.	9	4.0	5,764	1,757	30.9	— 0.6	....	sw.	......	......
1:08 p.m.	24.3	— 4.3	66	se.	8	3.6	6,335	1,931	31.1	— 0.5	....	sw.	......	......
1:40 p.m.	24.8	— 4.8	72	se.	10	4.5	7,395	2,254	27.0	— 2.8	....	sw.	......	......
1:58 p.m.	25.0	— 3.9	75	se.	11	4.9	5,851	1,783	32.9	0.5	....	sw.	......	......
2:02 p.m.	25.2	— 3.8	75	se.	13	5.8	5,291	1,613	29.1	— 1.6	....	sw.	......	......
2:05 p.m.	25.2	— 3.8	75	se.	13	5.8	4,541	1,384	31.6	— 0.2	....	sw.	......	......
2:17 p.m.	25.2	— 3.8	75	se.	13	5.8	4,060	1,238	30.7	— 0.7	....	ssw.	......	......
2:26 p.m.	26.0	— 3.3	64	se.	12	5.4	3,332	1,016	22.6	— 5.2	....	ssw.	......	......
2:35 p.m.	26.0	— 3.3	64	se.	12	5.4	2,524	769	20.5	— 6.4	....	sse.	......	......
2:50 p.m.	26.0	— 3.3	64	se.	9	4.0	1,725	526	26.0	— 3.3	64	se.	9	4.0

January 9, 1908.—Two kites were used; lifting surface, 102 sq. ft. (9.3 sq. m.). Wire out, 12,000 ft. (3,658 m.) at the maximum altitude.

A few St.-Cu. and St. clouds were visible during the flight, and long "standing" clouds formed over the Loudoun Valley.

Low pressure was central east of New England, and an area of high pressure extended from the Gulf to the Lakes.

January 10, 1908.—Four kites were used; lifting surface, 284 sq. ft. (26.2 sq. m). Wire out, 13,050 ft. (4,374 m.); at maximum altitude, 10,000 ft. (3,048 m.).

Ci. clouds moving from the southwest varied in amount from 5/10 at the beginning of the flight to 2/10 at its close.

Centers of high pressure lay over Virginia and north of Lake Ontario. An area of low pressure was central in eastern Texas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
Jan. 11:														
8:30 a. m.	23.8	− 4.6	68	sw.	12	5.4	1,725	526	23.8	− 4.6	68	sw.	12	5.4
8:48 a. m.	22.7	− 5.2	77	se.	14	6.3	2,855	870	36.0	2.2	....	sse.	......	......
8:57 a. m	21.7	− 5.7	83	se.	13	5.8	3,651	1,113	34.7	1.5	....	s.	......	......
9:26 a. m	23.5	− 4.7	79	se.	10	4.5	5,401	1,646	31.6	− 0.2	....	sw.	......	......
9:39 a. m.	24.9	− 3.9	76	se.	12	5.4	6,352	1,936	27.5	− 2.5	....	sw.	......	......
9:50 a. m.	27.1	− 2.7	69	se.	12	5.4	7,015	2,138	26.1	− 3.3	....	sw.	......	......
10:06 a. m.	29.0	− 1.7	67	se.	13	5.8	7,000	2,134	37.0	2.8	....	sw.	......	......
10:12 a. m.	29.0	− 1.7	68	se.	13	5.8	7,255	2,211	37.0	2.8	....	sw.	......	......
11:30 a. m.	29.8	− 1.5	75	se.	12	5.4	9,071	2,765	30.9	− 0.6	....	ssw.	......	......
11:02 a. m.	30.8	− 0.7	81	se.	18	8.0	9,565	2,915	32.5	0.8	....	ssw.	......	......
11:21 a. m.	31.9	− 0.1	76	se.	18	8.0	8,525	2,598	33.8	1.0	....	ssw.	......	......
11:30 a. m.	32.9	0.5	71	se.	18	8.0	6,825	2,080	27.7	− 2.4	....	ssw.	......	......
12:02 p. m.	33.8	1.0	62	se.	16	7.2	3,058	932	39.0	3.9	....	sse.	......	......
12:10 p. m.	32.8	0.4	66	se.	16	7.2	2,480	756	34.3	1.3	....	se.	......	......
12:30 p. m.	30.4	− 0.9	81	se.	16	7.2	1,725	526	30.4	− 0.9	81	se.	16	7.2
Jan. 13:														
7:38 a. m.	35.6	2.0	81	w.	10	4.5	1,725	526	35.6	2.0	81	w.	10	4.5
7:50 a. m.	36.0	2.2	80	w.	11	4.9	2,858	870	33.8	1.0	....	wnw.	......	......
8:05 a. m.	36.2	2.3	77	w.	13	5.8	3,848	1,173	29.5	− 1.4	....	wnw.	......	......
8:20 a. m	36.0	2.2	78	w.	12	5.4	4,954	1,510	23.4	− 4.8	....	wnw.	......	......
8:32 a. m.	36.2	2.3	76	sw.	12	5.4	5,589	1,704	20.1	− 6.6	....	wnw.	......	......
8:38 a. m.	36.2	2.3	76	sw.	12	5.4	6,357	1,938	21.2	− 6.0	....	w.	......	......
9:08 a. m.	36.0	2.2	78	nw.	9	4.0	6,071	1,850	21.6	− 5.8	....	w.	......	......
9:18 a. m.	35.8	2.1	78	w.	5	2.2	5,526	1,684	19.8	− 6.8	....	wnw.	......	......
9:25 a. m.	35.6	2.0	78	nw.	7	3.1	4,344	1,324	24.8	− 4.0	....	wnw.	......	......
9:32 a. m.	35.8	2.1	78	w.	8	3.6	2,873	876	30.4	− 0.9	....	wnw.	......	......
9:34 a. m.	35.6	2.0	78	w.	8	3.6	2,800	853	31.6	− 0.2	...	nw.	......	......
9:45 a. m.	35.7	2.1	78	w.	8	3.6	1,725	526	35.7	2.1	78	w.	8	3.6

January 11, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 17,000 ft. (5,182 m.); at maximum altitude, 14,500 ft. (4,420 m.).

At the beginning of the flight the sky was nearly covered with St.-Cu. moving from the southwest. By 10 a. m. the cloudiness had decreased in amount, and part of the lower clouds had given way to Ci. from the west. Near the end of the flight 5/10 A.-Cu. from the west and 3/10 St.-Cu. from the southwest were present. Between 9:10 and 11:25 a. m. thin clouds occasionally past under the head kite, which was hidden at 11:12 a. m.

High pressure was central over the region between New Jersey and the St. Lawrence. A well-defined depression lay over Mississippi.

January 13, 1908.—Two kites were used; lifting surface, 142 sq. ft. (13.1 sq. m.). Wire out, 8,000 ft. (2,438 m.); at maximum altitude, 7,500 ft. (2,286 m.).

At the beginning of the flight the sky was overcast with St.-Cu. moving from the west. By 8:20 a. m. these clouds had diminished to 3/10, and the direction had changed to west-northwest. A.-Cu. were observed above moving from the west-southwest. From this time on the St.-Cu. increased, covering the sky from 9:30 a. m. until the end of the flight. In the ascent clouds first past under the head kite at an altitude of 6,357 ft. (1,938 m.). In descending the kite appeared below the clouds at 4,344 ft. (1,324 m.).

Pressure was low over the eastern United States, with a center of 29.0 inches over Nova Scotia.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.					Miles	Met's							Miles	Met's
Jan. 14:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
11:18 a. m.	24.7	- 4.1	63	nw.	42	18.8	1,725	526	24.7	- 4.1	63	nw.	42	18.8
11:25 a. m.	24.7	- 4.1	63	nw.	38	17.0	2,594	791	15.8	- 9.0	....	nw.	......	.....
11:34 a. m.	24.7	- 4.1	56	nw.	40	17.9	3,129	954	14.5	- 9.7	....	nw.	......	.....
11:46 a. m.	24.9	- 3.9	51	nw.	42	18.8	3,824	1,166	22.8	- 5.1	....	nw.	......	.....
12:08 p. m.	25.5	- 3.6	53	nw.	31	13.9	4,752	1,448	23.7	- 4.6	....	nw.	......	.....
12:14 p. m.	26.0	- 3.3	52	nw.	30	13.4	5,760	1,756	20.5	- 6.4	....	nw.	......	.....
12:40 p. m.	26.8	- 2.9	51	nw.	30	13.4	3,760	1,146	21.2	- 6.0	....	nw.	......	.....
12:50 p. m.	26.5	- 3.1	50	nw.	26	11.6	3,446	1,050	14.0	-10.0	....	nw.	......	.....
1:08 p. m.	27.0	- 2.8	48	nw.	28	12.5	2,748	838	17.6	- 8.0	....	nw.	......	.....
1:27 p. m.	27.6	- 2.4	49	nw.	30	13.4	1,725	526	27.6	- 2.4	49	nw.	30	13.4
Jan. 15:														
7:17 a. m.	24.0	- 4.4	61	s.	13	5.8	1,725	526	24.0	- 4.4	61	s.	13	5.8
7:26 a. m.	24.0	- 4.4	61	s.	11	4.9	2,832	863	27.5	- 2.5	....	ssw.	......	.....
7:43 a. m.	24.2	- 4.3	61	s.	18	8.0	3,693	1,126	25.7	- 3.5	....	sw.	......	.....
8:02 a. m.	25.0	- 3.9	63	s.	16	7.2	4,432	1,351	23.7	- 4.6	....	sw.	......	.....
8:35 a. m.	26.4	- 3.1	59	s.	15	6.7	6,680	2,036	25.3	- 3.7	....	sw.	......	.....
9:17 a. m.	26.9	- 2.1	60	sse.	15	6.7	8,165	2,489	30.0	- 1.1	....	wsw.	......	.....
9:45 a. m.	28.0	- 2.2	61	se.	17	7.6	12,434	3,790	16.2	- 8.8	....	wsw.	......	.....
10:05 a. m.	29.3	- 1.5	56	se.	16	7.2	15,082	4,598	11.8	-11.2	....	wsw.	......	.....
10:35 a. m.	29.9	- 1.2	57	se.	18	8.0	16,382	4,993	5.5	-14.7	....	wsw.	......	.....
11:00 a. m.	30.3	- 0.9	54	se.	20	8.9	17,987	5,483	0.7	-17.4	....	wsw.	......	.....
11:31 a. m.	31.1	- 0.5	56	se.	18	8.0	16,762	5,109	5.9	-14.5	....	wsw.	......	.....
12:20 p. m.	33.0	0.6	56	se.	18	8.0	10,266	3,129	23.0	- 5.0	....	wsw.	......	.....
12:58 p. m.	33.6	0.9	51	se.	17	7.6	8,378	2,552	25.2	- 3.8	....	sw.	......	.....
1:27 p. m.	35.0	1.7	55	se.	17	7.6	5,350	1,631	33.1	0.6	....	sw.	......	.....
1:38 p. m.	34.8	1.6	54	se.	16	7.2	3,933	1,199	31.6	- 0.2	....	ssw.	......	.....
1:46 p. m.	35.0	1.7	52	se.	15	6.7	2,763	842	27.1	- 2.7	....	sse.	......	.....
1:55 p. m.	35.0	1.7	52	se.	15	6.7	1,725	526	35.0	1.7	52	se.	15	6.7
Jan. 16:														
7:20 a. m.	39.7	4.3	50	sw.	17	7.6	1,725	526	39.7	4.3	50	sw.	17	7.6
7:48 a. m.	39.5	4.2	48	sw.	17	7.6	2,836	864	36.3	2.4	....	wsw.	......	.....
8:00 a. m.	39.0	3.9	52	sw.	17	7.6	3,388	1,033	33.6	0.9	....	wsw.	......	.....
8:15 a. m.	39.5	4.2	52	sw.	17	7.6	4,710	1,436	27.0	- 2.8	....	wsw.	......	.....
8:25 a. m.	40.0	4.4	53	sw.	19	8.5	5,752	1,753	23.5	- 4.7	....	wsw.	......	.....
8:40 a. m.	40.0	4.4	53	sw.	14	6.3	6,252	1,906	26.4	- 3.1	....	w.	......	.....
9:08 a. m.	39.4	4.1	56	sw.	14	6.3	7,303	2,226	30.0	- 1.3	....	w.	......	.....
10:22 a. m.	39.8	4.3	58	sw.	12	5.4	8,521	2,597	24.3	- 4.3	....	w.	......	.....
10:27 a. m.	39.7	4.3	58	w.	12	5.4	7,209	2,197	28.2	- 2.1	....	w.	......	.....
10:40 a. m.	34.2	1.2	59	sw.	12	5.4	6,062	1,848	23.2	- 4.9	....	w.	......	.....
10:52 a. m.	38.8	3.8	60	w.	10	4.5	4,001	1,220	28.9	- 1.7	....	wsw.	......	.....
11:06 a. m.	38.5	3.6	62	sw.	11	4.9	2,962	903	33.8	1.0	....	wsw.	......	.....
12:03 p. m.	38.0	3.3	51	w.	13	5.8	1,725	526	38.0	3.3	51	w.	13	5.8

January 14, 1908.—Two kites were used: lifting surface, 102 sq. ft. (9.3 sq. m.). Wire out, 11,000 ft. (3,353 m.); at maximum altitude.

Until noon a few St.-Cu. were moving from the west-northwest near the horizon; no clouds thereafter.

Pressure was low over Nova Scotia and high over Louisiana.

January 15, 1908.—Five kites were used; lifting surface, 352 sq. ft. (32.5 sq. m.). Wire out, 33,750 ft. (10,287 m.) at the maximum altitude.

A few Ci. moving from the northwest were observed at 9:25 a. m. Ci. moving from the west appeared just before noon, and partly covered the sky after 12:30 p. m.

Pressure was high over the Atlantic coast from Pennsylvania to Florida. Low pressure was central over Wisconsin and thence southwestward to New Mexico.

January 16, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude, 19,700 ft. (6,005 m.).

During the flight the sky was overcast; at the beginning with A.-St. from the west-southwest, at the end with St.-Cu. moving rapidly from the west.

A depression lay over the St. Lawrence, and a secondary over New Orleans. Pressure was high over Florida, and higher over Kansas and northern Texas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m., 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Jan. 17:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:06 p. m.	28.7	— 1.8	66	sse.	12	5.4	1,725	526	28.7	— 1.8	66	sse.	12	5.4
1:20 p. m.	29.3	— 1.5	64	sse.	18	8.0	2,564	781	27.0	— 2.8	....	s.	......	......
1:30 p. m.	30.3	— 0.9	62	sse.	13	5.8	3,393	1,034	32.4	0.2	....	sw.	......	......
1:41 p. m.	30.6	— 0.8	62	sse.	16	7.2	4,737	1,444	28.9	— 1.7	....	w.	......	......
1:53 p. m.	31.2	— 0.4	61	se.	15	6.7	5,778	1,760	29.7	— 1.3	....	w.	......	......
2:11 p. m.	33.1	0.6	60	sse.	15	6.7	7,892	2,405	28.8	— 1.8	....	wnw.	......	......
2:27 p. m.	32.5	0.3	56	sse.	15	6.7	9,118	2,779	25.0	— 3.9	....	wnw.	......	......
3:06 p. m.	32.5	0.3	54	sse.	14	6.3	11,874	3,619	13.5	—10.3	....	wnw.	......	......
3:52 p. m.	32.4	0.2	56	sse.	14	6.3	13,688	4,172	7.5	—13.6	....	wnw.	......	......
4:30 p. m.	31.0	— 0.6	60	se.	11	4.9	14,959	4,560	2.3	—16.5	....	w.	......	......
5:15 p. m.	29.5	— 1.4	64	se.	12	5.4	12,234	3,729	12.0	—11.1	....	w.	......	......
5:59 p. m.	29.0	— 1.7	67	se.	11	4.9	9,130	2,783	24.3	— 4.3	....	w.	......	......
6:31 p. m.	29.0	— 1.7	67	se.	12	5.4	6,226	1,898	32.7	0.4	....	w.	......	......
6:53 p. m.	29.0	— 1.7	67	se.	12	5.4	3,782	1,153	33.6	0.9	....	wsw.	......	......
7:07 p. m.	29.0	— 1.7	67	se.	15	6.7	1,725	526	29.0	— 1.7	67	se.	15	6.7
Jan. 18:														
7:56 a. m.	27.3	— 2.6	73	nw.	31	13.9	1,725	526	27.3	— 2.6	73	nw.	31	13.9
8:07 a. m.	27.3	— 2.6	73	nw.	37	16.5	2,627	801	22.3	— 5.4	....	nw.	......	......
8:18 a. m.	27.1	— 2.7	75	nw.	41	18.3	3,135	956	21.4	— 5.9	....	nw.	......	......
8:27 a. m.	27.3	— 2.6	73	nw.	40	17.9	3,730	1,137	32.9	0.5	....	nw.	......	......
9:05 a. m.	28.0	— 2.2	76	nw.	40	17.9	4,494	1,370	32.0	0.0	....	nw.	......	......
10:00 a. m.	29.2	— 1.6	70	nw.	35	15.6	5,557	1,694	27.3	— 2.6	....	nw.	......	......
10:37 a. m.	29.1	— 1.6	77	nw.	20	8.9	5,050	1,539	29.1	— 1.6	....	nw.	......	......
10:58 a. m.	29.7	— 1.3	73	nw.	40	17.9	3,787	1,154	32.0	0.0	....	nw.	......	......
11:10 a. m.	29.9	— 1.2	69	nw.	36	16.1	3,310	1,009	20.5	— 6.4	....	nw.	......	......
11:20 a. m	29.4	— 1.4	72	nw.	30	13.4	2,707	825	23.2	— 4.9	....	nw.	......	......
11:28 a. m.	29.7	— 1.3	73	nw.	30	13.4	1,725	526	29.7	— 1.3	73	nw.	30	13.4

January 17, 1908.—Five kites were used; lifting surface, 346 sq. ft. (32.0 sq. m.). Wire out, 33,300 ft. (10,150 m.); at maximum altitude, 31,000 ft. (9.449 m.).

A few Ci. moving from the west were visible until 3 p. m. About 6:30 p. m. 3/10 Ci.-Cu. from the west were present for a short time.

At 8 a. m. low pressure was central over Wisconsin, while centers of high pressure lay over central Virginia, northern Mississippi and Texas.

January 18, 1908.—Three kites were used for the flight; lifting surface, 146 sq. ft. (13.4 sq. m.). Wire out, 12,700 ft. (3,871 m.); at maximum altitude, 11,850 ft. (3,612 m.).

Ci.-Cu. moving from the west and St. from the northwest nearly covered the sky at the beginning of the flight. From 8:30 to 10:15 a. m. about two-thirds, and after 11 a. m. nearly all of the sky was hidden by St.-Cu. moving from the northwest. Long, heavy "standing" clouds, sometimes in three rolls, hung over both valleys after 8:30 a. m.

High pressure, central over Kansas, occupied the interior of the country. Relatively low pressure lay north of Lake Superior.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m., 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Jan. 20:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:35 a. m.	27.3	− 2.6	80	se.	11	4.9	1,725	526	27.3	− 2.6	80	se.	11	4.9
7:40 a. m.	27.3	− 2.6	80	se.	11	4.9	2,520	768	39.6	4.2	....	sw.	......	......
8:30 a. m.	33.4	0.8	49	sw.	20	8.9	4,355	1,327	36.0	2.2	....	sw.	......	......
8:47 a. m.	33.8	1.0	53	sw.	18	8.0	4,772	1,455	42.3	5.7	....	wsw.	......	......
9:08 a. m.	34.9	1.6	47	sw.	18	8.0	6,232	1,900	41.7	5.4	....	wsw.	......	......
9:35 a. m.	36.0	2.2	48	s.	14	6.3	6,880	2,097	37.2	2.9	....	w.	......	......
9:58 a. m.	36.0	2.2	49	s.	17	7.6	9,229	2,813	30.4	− 0.9	....	w.	......	......
10:17 a. m.	37.2	2.9	42	sw.	20	8.9	11,728	3,575	20.7	− 6.3	....	w.	......	......
10:47 a. m.	39.0	3.9	45	sw.	16	7.2	14,109	4,300	14.9	− 9.5	....	w.	......	......
11:37 a. m.	40.0	4.4	60	se.	6	2.7	16,958	5,169	3.9	−15.6	....	w.	......	......
12:15 p. m.	36.8	2.7	63	se.	6	2.7	15,253	4,649	10.8	−11.8	....	w.	......	......
12:49 p. m.	36.8	2.7	66	se.	9	4.0	12,765	3,819	16.9	− 8.4	....	wnw.	......	......
2:10 p. m.	41.0	5.0	49	se.	12	5.4	10,102	3,079	26.1	− 3.3	....	w.	......	......
2:50 p. m.	43.0	6.1	46	se.	11	4.9	8,131	2,478	34.2	1.2	....	w.	......	......
3:05 p. m.	43.6	6.4	48	s.	15	6.7	5,305	1,617	......	......	....	nw.	......	......
3:21 p. m.	44.1	6.7	41	s.	17	7.6	4,995	1,523	......	......	....	wnw.	......	......
3:30 p. m.	45.0	7.2	41	s.	16	7.2	4,135	1,260	......	......	....	w.	......	......
3:35 p. m.	45.0	7.2	39	s.	14	6.3	3,055	931	......	......	....	wsw.	......	......
3:43 p. m.	45.6	7.6	39	s.	14	6.3	2,485	757	......	......	....	sw.	......	......
3:44 p. m.	45.7	7.6	40	s.	14	6.3	2,295	699	......	......	....	ssw.	......	......
3:53 p. m.	45.5	7.5	41	s.	12	5.4	1,725	526	45.5	7.5	41	s.	12	5.4
Jan. 21:														
7:31 a. m.	49.1	9.5	15	w.	11	4.9	1,725	526	49.1	9.5	15	w.	11	4.9
8:00 a. m.	48.2	9.0	17	w.	10	4.5	2,801	854	46.4	8.0	....	w.	......	......
8:16 a. m.	47.8	8.0	20	w.	10	4.5	3,914	1,193	41.9	5.5	....	w.	......	......
8:45 a. m.	48.0	8.9	25	sw.	11	4.9	5,420	1,652	40.8	4.9	....	w.	......	......
9:20 a. m.	47.5	8.6	28	w.	7	3.1	6,786	2,053	34.7	1.5	....	wsw.	......	......
10:02 a. m.	48.3	9.1	28	w.	11	4.9	8,201	2,500	29.7	− 1.3	....	sw.	......	......
10:35 a. m.	48.3	9.1	28	w.	9	4.0	10,838	3,303	24.8	− 4.0	....	wsw.	......	......
11:37 a. m.	51.8	11.0	28	sw.	13	5.8	13,816	4,211	15.4	− 9.2	....	wsw.	......	......
12:29 p. m.	52.0	11.1	23	w.	12	5.4	15,924	4,854	7.9	−13.4	....	wsw.	......	......
12:47 p. m.	53.0	11.7	28	w.	11	4.9	18,154	5,533	2.1	−16.6	....	wsw.	......	......
1:14 p. m.	53.5	11.9	27	sw.	6	2.7	19,102	5,823	− 6.7	−21.5	....	wsw.	......	......
1:50 p. m.	53.0	11.7	30	sw.	5	2.2	18,768	5,720	− 3.1	−19.5	....	w.	......	......
2:20 p. m.	56.3	13.5	38	se.	3	1.3	16,284	4,963	5.9	−14.5	....	w.	......	......
3:20 p. m.	52.0	11.1	38	se.	4	1.8	13,154	4,009	16.2	− 8.8	....	w.	......	......
3:42 p. m.	50.2	10.1	41	se.	5	2.2	11,820	3,578	22.3	− 5.4	....	w.	......	......
4:03 p. m.	50.0	10.0	44	se.	6	2.7	9,652	2,942	27.7	− 2.4	....	w.	......	......
4:42 p. m.	45.8	7.7	51	se.	9	4.0	7,173	2,186	29.3	− 1.5	....	w.	......	......
5:00 p. m.	46.3	7.9	47	se.	9	4.0	5,128	1,563	40.8	4.9	....	wsw.	......	......
5:12 p. m.	46.2	7.9	46	se.	9	4.0	4,204	1,281	40.8	4.9	....	sw.	......	......
5:18 p. m.	46.2	7.9	46	se.	9	4.0	2,631	802	47.1	8.4	....	se.	......	......
5:33 p. m.	47.0	8.3	46	se.	9	4.0	1,725	526	47.0	8.3	46	se.	9	4.0

January 20, 1908.—Six kites were used; lifting surface, 413 sq. ft. (38.3 sq. m.). Wire out, 33,350 ft. (10,165 m.); at maximum altitude, 32,000 ft. (9,754 m.).

During the flight from 4/10 to 7/10 of upper clouds, mostly Ci., were present. By 9.30 a. m. the cloud direction had changed from west-southwest to west. Ci.-Cu. and A.-Cu. constituted about half of the clouds of the afternoon.

Pressure was high, except in the extreme Northwest, the crest of the Atlantic high lying over North Carolina and Virginia and of the Southwest high over Colorado.

January 21, 1908.—Six kites were used; lifting surface, 414 sq. ft. (38.3 sq. m.). Wire out, 33,300 ft. (10,150 m.); at maximum altitude, 32,000 ft. (9,754 m.).

Ci., Ci.-St., and Ci.-Cu. moving from the west, in amounts varying from 6/10 to 10/10, were present during the greater part of the flight. A.-St. appeared about 4:30 p. m. and St.-Cu. near the end of the flight, both moving from the west.

At 8 a. m. high pressure was central over the Carolinas, low pressure over Lake Superior.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Jan. 22:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:30 a. m.	45.0	7.2	71	nw.	16	7.2	1,725	526	45.0	7.2	71	nw.	16	7.2
7:38 a. m.	45.0	7.2	71	nw.	16	7.2	2,953	900	41.9	5.5	....	wnw.	......	......
7:54 a. m.	45.0	7.2	71	nw.	14	6.8	3,988	1,216	37.2	2.9	....	wnw.	......	......
8:10 a. m.	45.0	7.2	66	nw.	17	7.6	5,581	1,701	30.9	- 0.6	....	wnw.	......	......
9:18 a. m.	46.0	7.8	45	nw.	16	7.2	1,725	526	46.0	7.8	45	nw.	16	7.2
Jan. 23:														
7:00 a. m.	28.5	- 1.9	78	se.	18	5.8	1,725	526	28.5	- 1.9	73	se.	18	5.8
7:37 a. m.	28.0	- 2.2	78	se.	14	6.3	2,793	851	25.2	- 3.8	....	se.	......	......
7:51 a. m.	28.0	- 2.2	78	se.	12	5.4	3,251	991	27.3	- 2.6	....	s.	......	......
8:09 a. m.	28.0	- 2.2	77	se.	12	5.4	4,064	1,289	23.0	- 5.0	....	sw.	......	......
8:31 a. m.	28.0	- 2.2	77	se.	12	5.4	4,668	1,423	20.3	- 6.5	....	sw.	......	......
9:19 a. m.	28.7	- 1.8	71	se.	10	4.5	6.804	2,074	14.7	- 9.6	....	sw.	......	......
9:36 a. m.	28.8	- 1.8	69	se.	8	3.6	7,739	2,359	14,7	- 9.6	....	sw.	......	......
10:10 a. m.	29.0	- 1.7	67	se	8	3.6	10,845	3,153	6.1	-14.4	....	sw.	......	......
10:27 a. m.	29.0	- 1.7	67	se.	7	3.1	11,996	3,656	- 1.1	-18.4	....	sw.	......	......
11:15 a. m.	29.3	- 1.5	68	se.	8	3.6	14,530	4,429	- 2.2	-19.0	....	sw.	......	......
11:45 a. m.	29.3	- 1.5	70	se.	6	2,7	10,864	3,312	2.5	-16.4	....	sw.	......	......
12:45 p. m.	28.0	- 2.2	80	se.	8	3.6	9,709	2,959	7.5	-13.6	....	sw.	......	......
1:12 p. m.	27.5	- 2.5	82	se.	10	4.5	8,237	2,511	9.3	-12.6	....	w.	......	......
1:37 p. m.	26.8	- 2.0	96	se.	7	3.1	4,644	1,416	18.1	- 7.7	....	w.	......	......
1:50 p. m.	27.0	- 2.8	98	se.	6	2,7	3,182	955	22.1	- 5.5	....	wsw.	......	......
1:58 p. m.	27.0	- 2.8	98	se.	6	2.7	1,725	526	27.0	- 2.8	98	se.	6	2.7
Jan. 24:														
11:27 a. m.	17.0	- 8.3	73	nw.	37	16.5	1,725	526	17.0	- 8.3	73	nw.	37	16.5
11:39 a. m.	17.0	- 8.3	74	nw.	37	16.5	2,658	810	12.2	-11.0	....	nw.	......	......
12:04 p. m.	18.0	- 7.8	68	nw.	35	15.6	3,369	1,027	10.6	-11.9	....	nw.	......	......
12:09 p. m.	18.3	- 7.6	66	nw.	32	14.3	3,904	1,190	18.3	- 7.6	....	n.	......	......
12:25 p. m.	18.6	- 7.4	65	nw.	42	18.8	5,282	1,610	18.5	- 7.5	....	n.	......	......
12:41 p. m.	19.3	- 7.1	66	nw.	39	17.4	4,268	1,301	18.3	- 7.6	....	n.	......	......
12:58 p. m.	19.8	- 6.8	68	nw.	36	16.1	3,368	1,179	9.3	-12.6	....	n.	......	......
1:27 p. m.	21.0	- 6.1	65	nw.	36	16.1	2,857	871	14.4	- 9.8	....	n.	......	......
1:39 p. m.	21.0	- 6.1	64	nw.	38	17.0	1,725	526	21.0	- 6.1	64	nw.	38	17.0

January 22, 1908.—Two kites were used; lifting surface, 142 sq. ft. (13.1 sq. m.). Wire out, 10,000 ft. (3,048 m.); at maximum altitude, 7,500 ft. (2,286 m.).

St.-Cu. moving from the west in amounts decreasing from 3/10 at the beginning were visible during the flight. A few Ci.-St. from the west appeared about 8:45 a. m.

Pressure was highest over Missouri and a low was central over the lower St. Lawrence.

January 23, 1908.—Four kites were used, lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 30,000 ft. (9.144 m.); at maximum altitude, 29,000 ft. (8,839 m.).

During the flight the sky was overcast with St.-Cu. or Nb., moving from the southwest, until 8 a. m., from the south-southwest thereafter. Light snow fell from 7:58 until 8:28 a. m., and after 11:45 a. m. In the ascent the head kite entered St.-Cu. at about 5,300 ft. (1,615 m.), and in descending emerged from the Nb. at about 4,600 ft. (1,402 m.).

Centers of relatively low pressure lay over the Lakes and over North Carolina, while an area of very high pressure occupied the Missouri River Valley.

January 24, 1908.—Two kites were used; lifting surface, 98 sq. ft. (9.1 sq. m.). Wire out, 10,000 ft. (3,048 m.) at the maximum altitude.

At the beginning of the flight the sky was partly covered with Ci.-St. moving from the northwest, but the amounts gradually decreased and only a few St.-Cu. from the north were visible at the end of the flight.

High pressure, central over western Tennessee, occupied the Mississippi Valley. A small but active low was south of Nantucket.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity	
1908. Jan. 25:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
9:42 a. m.	26.1	− 3.3	25	w.	20	8.9	1,725	526	26.1	− 3.3	25	w.	20	8.9
10:00 a. m.	25.7	− 3.5	30	w.	15	6.7	3,017	920	24.6	− 4.1	....	wnw.	......	......
10:10 a. m.	27.5	− 2.5	35	w.	12	5.4	3,770	1,149	26.6	− 3.0	....	wnw.	......	......
10:34 a. m.	29.3	− 1.5	21	w.	16	7.2	5,094	1,553	21.6	− 5.8	....	wnw.	......	......
11:52 a. m.	32.7	0.4	27	sw.	16	7.2	6,488	1,978	16.7	− 8.5	....	wnw.	......	......
12:07 p. m.	33.4	0.8	28	sw.	12	5.4	5,763	1,757	19.2	− 7.1	....	wnw.	......	......
12:18 p. m.	33.7	0.9	28	sw.	15	6.7	4,643	1,415	17.6	− 8.0	....	w.	......	......
12:29 p. m.	33.8	1.0	35	sw.	16	7.2	3,448	1,051	24.3	− 4.3	....	wsw.	......	......
12:48 p. m.	33.1	0.6	23	w.	20	8.9	1,725	526	33.1	0.6	23	w.	20	8.9
Jan. 27:														
10:16 a. m.	23.8	− 4.6	59	nw.	31	13.9	1,725	526	23.8	− 4.6	59	nw.	31	13.9
10:21 a. m.	23.8	− 4.6	55	nw.	43	19.2	3,089	942	17.4	− 8.2	....	wnw.	......	......
10:41 a. m.	24.0	− 4.4	51	nw.	44	19.7	4,125	1,257	11.1	−11.6	....	wnw.	......	......
11:03 a. m.	24.0	− 4.4	49	nw.	46	20.6	6,388	1,947	4.8	−15.1	....	nw.	......	......
11:32 a. m.	24.4	− 4.2	49	nw.	42	18.8	7,594	2,315	4.3	−15.4	....	nw.	......	......
11:56 a. m.	24.3	− 4.3	49	nw.	42	18.8	7,175	2,187	3.0	−16.1	....	nw.	......	......
12:33 p. m.	24.0	− 4.4	49	nw.	52	23.2	5,638	1,718	7.5	−13.6	....	nw.	......	......
2:00 p. m.	25.5	− 3.6	....	nw.	48	21.5	2,954	900	17.2	− 8.2	....	nw.	......	......
4:40 p. m.	22.6	− 5.2	53	nw.	35	15.6	1,725	526	22.6	− 5.2	53	nw.	35	15.6
Jan. 28:														
7:38 a. m.	21.0	− 6.1	57	sw.	11	4.9	1,725	526	21.0	− 6.1	57	sw.	11	4.9
7:48 a. m.	21.1	− 6.1	57	sw.	12	5.4	2,897	883	14.0	−10.0	....	sw.	......	......
8:11 a. m.	21.5	− 5.8	56	sw.	13	5.8	3,822	1,165	15.3	− 9.3	....	wnw.	......	......
8:21 a. m.	21.8	− 5.7	56	sw.	14	6.3	4,486	1,398	18.0	− 7.8	....	wnw.	......	......
8:50 a. m.	22.4	− 5.3	51	sw.	15	6.7	6,311	1,924	14.0	−10.0	....	w.	......	......
9:25 a. m	23.0	− 5.0	50	sw.	17	7.6	7,235	3,205	14.5	− 9.7	....	wsw.	......	......
9:58 a. m.	23.0	− 5.0	51	sw.	14	6.3	6,827	2,081	14.9	− 9.5	....	wsw.	......	......
10:17 a. m.	23.0	− 5.0	51	s.	14	6.3	4,605	1,404	20.3	− 6.5	....	w.	......	......
10:30 a. m.	23.2	− 4.9	52	se.	9	4.0	2,733	833	17.8	− 7.9	....	sw.	......	......
10:50 a. m.	24.0	− 4.4	53	se.	11	4.9	1,725	526	24.0	− 4.4	53	se.	11	4.9

January 25, 1908.—Three kites were used; lifting surface, 174 sq ft. (16.1 sq. m.). Wire out, 13,300 ft. (4,054 m.); at maximum altitude, 9,000 ft. (2,743 m,).

During the flight the sky was from 6/10 to 9/10 covered with Ci.-St., A.-Cu., and St.-Cu. moving from the west. "Standing" clouds of moderate size hung over Loudoun Valley during most of the flight.

High pressure was central over Florida. Areas of low pressure lay north of Lake Ontario and western Nebraska.

January 27, 1608.—Three kites were used; lifting surface, 146 sq. ft. (13.4 sq. m.). Wire out, 14,500 ft. (4,420 m.) at the maximum altitude.

St.-Cu. moving from the west-northwest covered two-thirds of the sky at the beginning of the flight. By noon the amount had diminished to 1/10 from the northwest. During the afternoon the clouds slowly increased to 7/10 at the end of the flight.

The head kite was in the clouds several times at elevations between 6,300 ft. (1,920 m.) and 7,100 ft. (2,164 m.).

A marked depression, with a central pressure of 28.95 inches over the middle St. Lawrence dominated the weather east of the Mississippi. A center of relatively high pressure lay over Arkansas.

January 28, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 13,500 ft. (4,115 m.) at the maximum altitude.

During the first half of the flight the sky was nearly covered with Ci.-Cu. and A.-Cu. moving from the west. Between 9:15 and 9:50 a. m. these clouds were replaced by St., also from the west, which overcast the sky at the end of the flight.

High pressure was central over Cape Hatteras. Areas of low pressure were over Nova Scotia and Michigan, and a secondary depression was over Missouri.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Jan. 29:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
11:06 a. m.	26.0	— 3.3	75	nw.	30	13.4	1,725	526	26.0	— 3.3	75	nw.	30	13.4
11:17 a. m.	26.0	— 3.3	75	nw.	30	13.4	2,725	831	18.3	— 7.6	....	nw.	......	......
11:26 a. m.	25.0	— 3.9	75	nw.	30	13.4	3,349	1,021	16.0	— 8.9	....	nw.	......	......
11:42 a. m.	24.2	— 4.3	72	nw.	30	13.4	4,065	1,239	15.3	— 9.3	....	nw.	......	......
11:51 a. m.	23.9	— 4.5	72	nw.	30	13.4	4,862	1,482	23.5	— 4.7	....	nw.	......	......
11:58 a. m.	23.9	— 4.5	68	nw.	30	13.4	5,652	1,723	23.7	— 4.6	....	nw.	......	......
12:18 p. m.	23.5	— 4.7	54	nw.	35	15.6	6,293	1,918	22.5	— 5.3	....	wnw.	......	......
12:32 p. m.	22.5	— 5.3	53	nw.	38	17.0	7,259	2,212	17.8	— 7.0	....	wnw.	......	......
12:40 p. m.	22.0	— 5.6	56	nw.	38	17.0	7,678	2,339	16.3	— 8.7	...	wnw.	......	......
1:17 p. m	21.5	— 5.8	61	nw.	31	13.9	8,714	2,656	13.5	—10.3	....	wnw.	......	......
1:32 p. m.	21.9	— 5.6	57	nw.	32	14.3	6,798	2,072	17.8	— 7.9	....	wnw.	......	......
1:50 p. m.	22.9	— 5.1	54	nw.	32	14.3	5,413	1,650	23.0	— 5.0	....	nw.	......	......
2:15 p. m.	23.2	— 4.9	57	nw.	28	12.5	4,175	1,273	23.0	— 5.0	....	nw.	......	......
2:29 p. m.	21.0	— 6.1	68	nw.	30	13.4	3,590	1,094	12.2	—11.0	....	nw.	......	......
2:37 p. m.	21.0	— 6.1	68	nw.	26	11.6	2,683	818	15.8	— 9.0	....	nw.	......	......
2:56 p. m.	21.6	— 5.8	64	nw.	25	11.2	1,725	526	21.6	— 5.8	64	nw.	25	11.2
Jan. 30:														
9:58 a. m.	7.5	—13.6	69	nw.	30	13.4	1,725	526	7.5	—13.6	69	nw.	30	13.4
10:09 a. m.	8.0	—13.3	70	nw.	33	14.8	2,552	778	3.0	—16.1	....	nnw.	......	......
10:23 a. m.	8.0	—13.3	70	nw.	31	13.9	3,550	1,082	16.0	— 8.9	....	nw.	......	......
10:42 a. m.	9.0	—12.8	67	nw.	27	12.1	4,295	1,309	15.4	— 9.2	....	nw.	......	......
11:00 a. m.	10.0	—12.2	64	nw.	24	10.7	6,533	1,991	9.7	—12.4	....	nw.	......	......
11:18 a. m.	10.6	—11.9	63	nw.	22	9.8	8,125	2,477	5.2	—14.9	....	nw.	......	......
11:37 a. m.	10.5	—11.9	63	nw.	20	8.9	9,830	2,996	— 1.1	—18.4	....	nnw.	......	......
11:52 p. m.	12.2	—11.0	64	nw.	19	8.5	10,785	3,287	— 2.6	—19.2	....	w.	......	......
12:30 p. m.	13.3	—10.4	52	nw.	21	9.4	9,483	2,890	0.7	—17.4	...	w.	......	......
12:55 p. m.	14.3	— 9.8	51	nw.	22	9.8	8,551	2,606	5.9	—14.5	....	wnw.	......	......
1:11 p. m.	14.0	—10.0	47	nw.	17	7.6	6,968	2,124	7.7	—13.5	....	nw.	......	......
1:23 p. m.	15.0	— 9.4	49	nw.	15	6.7	4,789	1,460	11.5	—11.4	....	nw.	......	......
1:26 p. m.	15.2	— 9.3	49	nw.	15	6.7	4,185	1,276	10.9	—11.7	....	nw.	......	......
1:38 p. m.	15.0	— 9.4	51	nw.	15	6.7	3,589	1,094	5.0	—15.0	....	nnw.	......	......
1:50 p. m.	15.3	— 9.3	53	nw.	14	6.3	2,603	793	7.7	—13.6	....	nw.	......	......
2:00 p. m.	16.3	— 8.7	51	nw.	14	6.3	1,725	526	16.3	— 8.7	51	nw.	14	6.3

January 29, 1908.—Three kites were used; lifting surface, 146 sq. ft. (13.5 sq.m.). Wire out, 15,000 ft. (4,572 m.); at maximum altitude, 12,500 ft. (3,810 m.).

St.-Cu. and some Ci.-St. nearly obscured the sky at the beginning of the flight. The proportion of lower clouds slowly decreased, and A.-St. appeared just after noon, increasing to 8/10 by 12:30 p. m. At 1:30 p. m. 4/10 Ci.-St., and 5/10 A.-Cu. were visible. By 2:15 p. m. the cloud amounts had decreased to 6/10. The clouds were moving from the northwest thruout the flight. The head kite was in St.-Cu., visible occasionally thru rifts, between the altitudes of 3,349 ft. (1,021 m.) and 8,714 ft. (2,656 m.) in ascending.

High pressure, central over Iowa, covered the country from the Rocky Mountains to the Blue Ridge. Low pressure was central over the lower St. Lawrence, and a secondary depression was over Cape Hatteras.

January 30, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude the same.

Ci.-St. appeared at 11 a. m. and increased gradually to 4/10 moving from the west at the end of the flight. A solar halo was seen at 1:26 p. m. A few Ci.-Cu. from the west-northwest were observed at 12:25 p. m.

Pressure was relatively low over Nova Scotia, while high pressure, central over the Lakes, covered the United States east of the Rocky Mountains.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Jan. 31:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:30 a.m.	4.0	−15.6	84	se.	9	4.0	1,725	526	4.0	−15.6	84	se.	9	4.0
8:37 a.m.	5.5	−14.7	78	e.	18	5.8	2,835	864	9.5	−12.5	....	sw.	......	......
10:33 a.m.	11.0	−11.7	69	se.	12	5.4	3,892	1,186	9.3	−12.6	....	wsw.	......	......
10:43 a.m.	11.0	−11.7	67	se.	12	5.4	5,497	1,676	22.1	− 5.5	....	wsw.	......	......
11:05 a.m.	13.0	−10.6	64	se.	13	5.8	9,991	3,045	9.5	−12.5	....	w.	......	......
11:45 a.m.	16.0	− 8.9	60	se.	16	7.2	13,273	4,046	− 1.3	−18.5	....	w.	......	......
12:16 p.m.	17.0	− 8.3	58	se.	16	7.2	14,830	4,520	− 1.7	−18.7	....	w.	......	......
12:37 p.m.	18.5	− 7.5	58	se.	16	7.2	16,837	5,132	− 3.1	−19.5	....	w.	......	......
1:06 p.m.	19.2	− 7.1	60	se.	18	8.0	15,271	4,655	− 1.8	−18.8	....	w.	......	......
1:36 p.m.	19.4	− 7.0	63	se.	19	8.5	13,139	4,005	− 1.3	−18.5	....	w.	......	......
2:04 p.m.	19.8	− 6.8	63	se.	17	7.6	11,303	3,445	6.3	−14.3	....	w.	......	......
2:32 p.m.	18.4	− 7.8	63	se.	17	7.6	8,336	2,541	16.3	− 8.7	....	w.	......	......
2:52 p.m.	18.9	− 7.3	63	se.	22	9.8	6,648	2,026	29.3	− 1.5	....	w.	......	......
3:07 p.m.	19.0	− 7.2	63	se.	17	7.6	3,810	1,161	19.0	− 7.2	....	ssw.	......	......
3:26 p.m.	19.0	− 7.2	62	se.	19	8.5	1,725	526	19.0	− 7.2	62	se.	19	8.5
Feb. 1:														
11:28 a.m.	33.0	0.6	93	w.	17	7.6	1,725	526	33.0	0.6	93	w.	17	7.6
11:49 a.m.	31.4	− 0.3	100	nw.	15	6.7	2,778	847	33.6	0.9	....	w.	......	......
11:56 a.m.	30.7	− 0.7	100	nw.	15	6.7	4,080	1,244	28.2	− 2.1	....	w.	......	......
12:10 p.m.	30.3	− 0.9	100	w.	25	11.2	4,869	1,484	24.6	− 4.1	....	w.	......	......
12:51 p.m.	33.2	0.7	88	w.	38	17.0	3,494	1,065	27.1	− 2.7	....	w.	......	......
12:58 p.m.	33.6	0.9	85	nw.	40	17.9	2,725	830	30.4	− 0.9	....	w.	......	......
1:06 p.m.	34.0	1.1	82	nw.	45	20.1	1,725	526	34.0	1.1	82	nw.	4.5	20.1
Feb. 3:														
9:45 a.m.	16.0	− 8.9	33	sw.	12	5.4	1,725	526	16.0	− 8.9	33	sw.	12	5.4
9:54 a.m	17.0	− 8.3	35	sw.	10	4.5	3,017	920	15.1	− 9.4	....	w.	......	......
10:05 a.m.	18.0	− 7.8	35	sw.	9	4.0	4,150	1,265	10.8	−11.8	....	w.	......	......
10:17 a.m.	18.8	− 7.3	32	sw.	11	4.9	5,358	1,633	8.4	−13.1	....	wnw.	......	......
11:15 a.m.	22.0	− 5.6	39	s.	5	2.2	5,810	1,771	9.5	−12.5	....	w.	......	......
12:04 p.m.	25.4	− 3.7	42	s.	7	3.1	4,645	1,416	10.4	−12.0	....	w.	......	......
12:14 p.m.	24.0	− 4.4	41	s.	7	3.1	3,411	1,040	14.9	− 9.5	....	w.	......	......
12:32 p.m.	24.5	− 4.2	39	s.	7	3.1	1,725	526	24.5	− 4.2	39	s.	7	3.1

January 31, 1908.—Five kites were used; lifting surface, 276 sq. ft. (32.0 sq. m.). Wire out, 30,000 ft. (9,144 m.); at maximum altitude, 29,000 ft. (8,839 m.).

From 1/10 to 3/10 of Ci. or Ci.-Cu. moving from the west were present until 11 a. m. Similar clouds appeared after noon and had nearly covered the sky by 1 p. m. Two-thirds of these clouds had given place to St., also from the west, by 2:30 p. m. After 2:50 p. m. the sky was nearly overcast with A.-St. moving from the west. At 2:28 p. m. the head kite past into A.-St. and emerged therefrom at 2:32 p. m. at an altitude of 8,336 ft. (2,541 m.).

High pressure was central over eastern Maryland and New Jersey, low pressure over Oklahoma.

February 1, 1908.—One kite was used; lifting surface, 59 sq. ft. (5.4 sq. m.) Wire out, 8,000 ft. (2,438 m.); at maximum altitude, 7,350 ft. (2,240 m.).

Light fog, and 9/10 St. from the west-southwest, were present at the beginning of the flight. Fog was dense from 11:50 a. m. to 12:15 p. m., and was light thereafter until 1 p. m. The kite was visible at intervals thru rifts in the fog. Snow fell from 11:58 a. m. until 12:47 p. m. At 12:53 p. m. the sky was overcast with St. moving from the west-southwest.

A severe storm was central over Lake Huron and rain or snow was falling from Virginia to Tennessee northward. Pressure was high over Kansas and higher over the northern Rocky Mountain region.

February 3, 1908.– Two kites were used; lifting surface, 142 sq. ft. (13.1 sq. m.). Wire out, 10,300 ft. (3,139 m.); at maximum altitude the same.

During the flight a few Ci. were moving from the west.

Pressure was relatively low over Lake Ontario, and was high over the South Atlantic and Gulf States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Feb. 4:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:23 a. m.	12.0	−11.1	76	nw.	15	6.7	1,725	526	12.0	−11.1	76	nw.	15	6.7
7:30 a. m.	12.0	−11.1	78	nw.	17	7.6	2,898	883	4.6	−15.2	...	nw.	......	......
7:43 a. m.	12.0	−11.1	78	nw.	22	9.8	3,803	1,159	0.9	−17.3	....	nw.	......	......
7:55 a. m.	12.0	−11.1	76	nw.	24	10.7	4,137	1,261	9.7	−12.4	....	nnw.	......	......
8:12 a. m.	11.8	−11.2	80	nw.	27	12.1	5,713	1,741	7.5	−13.6	....	nnw.	......	......
8:44 a. m	13.0	−10.1	71	nw.	15	6.7	7,068	2,154	2.1	−16.6	....	nnw.	......	......
9:37 a. m.	14.0	−10.0	71	nw.	22	9.8	9,770	2,978	0.7	−17.4	....	nnw.	......	......
10:12 a. m.	14.8	− 9.6	73	nw.	22	9.8	7,495	2,285	2.3	−16.5	....	nnw.	......	......
10:35 a. m.	15.6	− 9.1	73	nw.	22	9.8	5,688	1,734	7.5	−13.6	....	nw.	......	......
10:45 a. m.	15.6	− 9.1	73	nw.	25	11.2	4,875	1,486	10.4	−12.0	....	nw.	......	......
10:53 a. m.	15.8	− 9.3	65	nw.	25	11.2	3,837	1,170	4.8	−15.1	....	nw.	......	......
11:05 a. m.	16.0	− 8.9	65	nw.	26	11.6	3,207	978	5.5	−14.7	....	wnw.	......	......
11:07 a. m.	16.0	− 8.9	65	nw.	26	11.6	2,559	777	9.0	−12.8	....	wnw.	......	......
11:15 a. m.	15.8	− 9.0	61	nw.	26	11.6	1,725	526	15.8	− 9.0	61	nw.	26	11.6
Feb. 5:														
7:32 a. m.	6.8	−14.3	88	se.	18	8.0	1,725	526	6.8	−14.3	88	se.	18	8.0
7:41 a. m.	6.5	−14.2	88	se.	18	8.0	2,687	819	10.0	−12.2	....	s.	......	......
7:57 a. m.	6.5	−14.2	90	se.	18	8.0	3,010	917	11.8	−11.2	....	s.	......	......
8:15 a. m.	6.7	−14.1	88	se.	19	8.5	4,093	1,248	15.1	− 9.4	....	sw.	......	......
8:30 a. m.	7.0	−13.9	95	se.	20	8.9	5,133	1,565	15.3	− 9.3	....	sw.	......	......
9:40 a. m.	9.0	−12.8	82	se.	23	10.3	6,083	1,854	24.6	− 4.1	....	sw.	......	......
10:23 a. m.	8.9	−12.8	88	se.	24	10.7	4,949	1,508	14.9	− 9.5	....	sw.	......	......
10:43 a. m.	8.0	−13.3	95	se.	24	10.7	3,123	952	11.1	−11.6	....	sse.	......	......
10:51 a. m.	8.0	−13.3	95	se.	20	8.9	1,725	526	8.0	−13.3	95	se.	20	8.9
Feb. 6:														
8:26 a. m.	32.0	0.0	100	nw.	8	3.6	1,725	526	32.0	0.0	100	nw.	8	3.6
8:35 a. m.	32.0	0.0	100	nw.	9	4.0	2,882	878	37.6	3.1	....	wnw.	......	......
8:48 a. m.	30.0	− 1.1	100	nw.	9	4.0	3,892	1,186	32.4	0.2	....	w.	......	......
9:09 a. m.	32.0	0.0	98	nw.	11	4.9	5,375	1,638	25.5	− 3.6	....	wsw.	......	......
9:27 a. m.	31.4	− 0.3	97	nw.	14	6.3	7,198	2,194	22.6	− 5.2	....	w.	......	......
9:50 a. m	32.8	0.4	92	nw.	10	4.5	7,731	2,356	21.6	− 5.8	....	wsw.	......	......
10:28 a. m.	33.0	0.6	90	nw.	14	6.3	6,697	2,041	22.8	− 5.4	....	wsw.	......	......
10:40 a. m.	32.4	0.2	77	nw.	13	5.8	5,327	1,624	26.2	− 3.2	....	wsw.	......	......
10:45 a. m.	32.6	0.3	77	nw.	14	6.3	3,681	1,122	28.8	− 1.8	....	wsw.	......	......
11:10 a. m.	33.5	0.8	80	nw.	12	5.4	1,725	526	33.5	0.8	80	nw.	12	5.4

February 4, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude the same.

A few St. were moving from the northwest during the flight, and a few Ci., also from the northwest, were visible at its close.

High pressure, central over the Lake region, covered the Eastern States, while low pressure was centered over Yellowstone Park.

February 5, 1908.—Three kites were used; lifting surface, 146 sq. ft. (13.5 sq. m.). Wire out, 14,000 ft. (4,267 m.); at maximum altitude, 10,000 ft. (3,048 m.).

The sky was overcast with A.-St. from the southwest until about 8:15 a. m., when the clouds became lower. Snow fell after 8:33 a. m.

A low, central over Iowa, dominated the weather conditions from the Rocky Mountains to the Alleghanies, and rain or snow was falling over the Mississippi Valley and eastward to central Virginia. High pressure occupied the St. Lawrence Valley.

February 6, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 11,700 ft. (3,566 m.); at maximum altitude, 11,200 ft. (3,414 m.).

Light fog, and 7/10 St.-Cu. from the west were present at the beginning of the flight. The fog was dense from 8:42 to 8:45 a. m.; light fog continued thereafter until 8:59 a. m. The clouds were moving from the west-southwest when the fog lifted, and they decreased rapidly after 10 a. m. Only a few were visible at the close of the flight.

The flight was made in the southeast quadrant of a low central over Lake Huron. The barometer was high over the Gulf of St. Lawrence and over Texas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.					Miles	Met's							Miles	Met's
Feb. 7:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
2:18 p. m.	24.0	— 4.4	53	nw.	34	15.2	1,725	526	24.0	— 4.4	53	nw.	34	15.2
2:16 p. m.	24.0	— 4.4	53	nw.	34	15.2	2,706	825	18.7	— 7.4	....	nw.	......	......
2:28 p. m.	24.0	— 4.4	54	nw.	34	15.2	3,586	1,093	14.4	— 9.8	....	nw.	......	......
2:43 p. m.	24.2	— 4.3	55	nw.	35	15.6	4,298	1,310	15.1	— 9.4	....	nw.	......	......
2:55 p. m.	24.3	— 4.3	56	nw.	36	16.1	4,922	1,500	19.4	— 7.0	....	nw.	......	......
3:22 p. m.	24.0	— 4.4	56	nw.	29	13.0	6,340	1,933	18.9	— 7.3	....	wnw.	......	......
3:41 p. m.	24.1	— 4.4	56	nw.	30	13.4	4,708	1,435	19.4	— 7.0	....	wnw.	......	......
3:58 p. m.	24.2	— 4.3	56	nw.	29	13.0	3,853	1,174	13.8	—10.1	....	wnw.	......	......
4:10 p. m.	24.0	— 4.4	58	nw.	31	13.9	3,176	968	16.2	— 8.8	....	wnw.	......	......
4:20 p. m.	24.0	— 4.4	61	nw.	30	13.4	2,687	819	18.9	— 7.3	....	nw.	......	......
4:30 p. m.	24.0	— 4.4	59	nw.	31	13.9	1,725	526	24.0	— 4.4	59	nw.	31	13.9
Feb. 8:														
7:39 a. m.	11.0	—11.7	75	nw.	20	8.9	1,725	526	11.0	—11.7	75	nw.	20	8.9
7:50 a. m.	10.8	—11.8	78	nw.	24	10.7	2,687	819	6.1	—14.4	....	nnw.	......	......
8:01 a. m.	10.2	—12.1	79	nw.	26	11.6	3,083	940	5.4	—14.8	....	nw.	......	......
8:19 a. m.	10.0	—12.2	79	nw.	30	13.4	4,406	1,343	10.2	—12.1	....	nw.	......	......
8:38 a. m.	9.8	—12.3	79	nw.	32	14.3	5,718	1,742	14.9	— 9.5	....	nw.	......	......
9:18 a. m.	10.5	—11.9	68	nw.	28	12.5	7,223	2,202	13.3	—10.4	....	nw.	......	......
10:05 a. m.	11.2	—11.6	65	nw.	25	11.2	10,004	3,049	7.8	—13.4	....	nw.	......	......
10:47 a. m.	11.9	—11.2	60	nw.	18	8.0	8,411	2,564	10.9	—11.7	....	nw.	......	......
11:26 a. m.	13.2	—10.4	60	nw.	24	10.7	6,449	1,966	12.9	—10.6	....	nw.	......	......
11:44 a. m.	13.8	—10.1	58	nw.	20	8.9	4,803	1,464	2.3	—16.5	....	nw.	......	......
11:56 a. m.	13.5	—10.3	56	nw.	20	8.9	2,665	812	8.8	—12.9	....	nw.	......	......
12:00 m ...	14.0	—10.0	56	nw.	20	8.9	1,725	526	14.0	—10.1	56	nw.	20	8.9
Feb. 10:														
7:36 a. m.	12.0	—11.1	52	se.	9	4.0	1,725	526	12.0	—11.1	52	se.	9	4.0
7:45 a. m.	11.8	—11.2	54	se.	10	4.5	2,793	851	26.6	— 3.0	....	ssw.	......	......
8:01 a. m.	11.8	—11.2	54	se.	11	4.9	3,790	1,155	31.3	— 0.4	....	sw.	......	......
8:30 a. m.	11.6	—11.3	60	se.	14	6.3	5,166	1,575	31.8	— 0.1	....	sw.	......	......
8:47 a. m.	12.0	—11.1	60	se.	15	6.7	5,637	1,718	30.4	— 0.9	....	sw.	......	......
10:00 a. m.	13.6	—10.2	59	s.	10	4.5	6,969	2,124	28.4	— 2.0	....	wsw.	......	......
10:50 a. m.	16.8	— 8.4	48	s.	9	4.0	8,518	2,596	23.0	— 5.0	....	wsw.	......	......
11:45 a. m.	16.9	— 8.4	51	se.	15	6.7	9,960	3,036	16.2	— 8.8	....	wsw.	......	......
12:00 m ...	17.0	— 8.3	66	se.	12	5.4	8,865	2,702	21.0	— 6.1	....	wsw.	......	......
12:12 p. m.	17.6	— 8.0	63	se.	12	5.4	7,278	2,218	26.4	— 3.1	....	wsw.	......	......
12:28 p. m.	19.3	— 7.1	54	se.	11	4.9	5,501	1,677	35.2	1.8	....	wsw.	......	......
12:40 p. m.	19.4	— 7.0	52	se.	11	4.9	3,514	1,071	28.0	— 2.2	....	sw.	......	......
12:45 p. m.	19.0	— 7.2	49	se.	12	5.4	2,524	769	23.7	— 4.6	....	ssw.	......	......
12:53 p. m.	19.0	— 7.2	46	se.	11	4.9	1,725	526	19.0	— 7.2	46	se.	11	4.9

February 7, 1908.—Two kites were used; lifting surface, 99 sq. ft. (9.1 sq. m.). Wire out, 12,000 ft. (3,658 m.) at the maximum altitude.

A few St.-Cu. from the northwest were present during the flight.

Low pressure was central over Nova Scotia at 8 a. m.; and high pressure, central north of Minnesota, reached in a broad ridge southeastward thru the United States.

February 8, 1908.—Three kites were used; lifting surface, 174 sq. ft. (16.0 sq. m.). Wire out, 20,000 ft. (6,096 m.) at the maximum altitude.

At the beginning of the flight half of the sky was covered with St.-Cu. from the northwest, but only a few clouds were present after 8:10 a. m. Some Ci.-St. from the northwest were seen at 9:18 a. m.

Very high pressure, central over the Lakes, extended over practically all of the United States.

February 10, 1908.—Five kites were used; lifting surface, 346 sq. ft. (32.0 sq. m.). Wire out, 22,000 ft. (6,706 m.); at maximum altitude, 18,000 ft. (5,486 m.).

At the beginning of the flight the sky was overcast with A.-St. from west-southwest. These gradually diminished, and about 3/10 Ci. and 4/10 A.-St. from the same direction were present at the end of the flight. A solar halo was visible from 10:18 a. m. until 1 p. m.

Very high pressure was central over New England, and the barometer was relatively low over the Gulf.

RESULTS OF KITE FLIGHT.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity							Dir.	Velocity.	
1908.					Miles	Met's							Miles	Met's
Feb. 11:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
7:30 a. m.	30.8	− 0.7	50	nw.	8	3.6	1,725	526	30.8	− 0.7	50	nw.	8	3.6
8:31 a. m.	33.0	0.6	50	w.	5	2.2	3,809	1,161	36.9	2.7	....	ssw.	......	......
8:50 a. m.	32.3	0.2	52	se.	3	1.3	4,962	1,513	33.4	0.8	....	ssw.	......	......
10:39 a. m.	37.0	2.8	45	se.	3	1.3	5,762	1,756	30.0	− 1.1	....	ssw.	......	......
12:37 p. m.	38.2	3.4	55	se.	4	1.8	6,146	1,873	31.1	− 0.5	....	sw.	......	......
1:25 p. m.	38.0	3.3	54	e.	5	2.2	5,089	1,551	32.0	0.0	....	sw.	......	......
1:33 p. m.	37.3	2.9	54	e.	5	2.2	4,462	1,360	33.4	0.8	....	sw.	......	......
1:38 p. m.	37.3	2.9	54	se.	5	2.2	3,404	1,038	37.0	2.8	....	sw.	......	......
1:44 p. m.	37.0	2.8	52	se.	5	2.2	2,544	775	38.5	3.6	....	s.	......	......
1:54 p. m.	37.0	2.8	52	se.	5	2.2	1,725	526	37.0	2.8	52	se.	5	2.2
Feb. 12:														
7:18 a. m.	31.4	− 0.3	62	se.	12	5.4	1,725	526	31.4	− 0.3	62	se.	12	5.4
7:30 a. m.	31.4	− 0.3	64	se.	11	4.9	2,890	881	40.6	4.8	....	s.	......	......
7:41 a. m.	31.6	− 0.2	64	se.	11	4.9	3,945	1,203	37.9	3.3	....	s.	......	......
7:53 a. m.	31.9	− 0.1	61	se.	15	6.7	5,080	1,583	38.8	3.8	....	sw.	......	......
8:10 a. m.	32.0	0.0	61	se.	14	6.3	5,413	1,650	34.2	1.2	....	sw.	......	......
8:27 a. m.	32.6	0.3	61	se.	15	6.7	6,229	1,898	36.0	2.2	....	sw.	......	......
9:57 a. m.	32.0	0.0	76	ne.	16	7.2	8,668	2,642	29.5	− 1.4	....	wsw.	......	......
11:02 a. m.	33.6	0.9	77	se.	15	6.7	9,708	2,957	41.2	5.1	....	wsw.	......	......
11:35 a. m.	34.0	1.1	77	se.	15	6.7	10,542	3,213	37.6	3.1	....	wsw.	......	......
11:48 a. m.	34.4	1.3	77	se.	14	6.3	9,981	3,042	40.1	4.5	....	wsw.	......	......
12:04 p. m.	34.9	1.6	76	se.	13	5.8	9,338	2,446	30.7	− 0.7	....	wsw.	......	......
12:14 p. m.	35.1	1.7	76	se.	11	4.9	7,928	2,417	36.1	2.3	..	wsw.	......	......
12:32 p. m.	34.8	1.6	75	se.	13	5.8	5,687	1,733	41.5	5.3	....	sw.	......	......
12:40 p. m.	34.7	1.5	75	se.	14	6.3	3,480	1,061	39.9	4.4	....	s.	......	......
12:50 p. m.	34.5	1.4	77	se.	15	6.7	2,568	783	36.1	2.3	....	sse.	......	......
12:54 p. m.	34.0	1.1	79	se.	15	6.7	1,725	526	34.0	1.1	79	se.	15	6.7
Feb. 13:														
1:43 p. m.	35.9	2.2	100	se.	7	3.1	1,725	526	35.9	2.2	100	se.	7	3.1
3:50 p. m.	38.0	3.3	100	se.	5	2.2	2,902	884	46.6	8.1	....	w.	......	......
6:21 p. m.	36.0	2.2	100	nw.	11	4.9	3,368	1,027	47.8	8.8	....	wnw.	......	......
6:24 p. m.	36.7	2.6	100	nw.	11	4.9	4,387	1,337	44.1	6.7	....	wnw.	......	......
6:32 p. m.	38.0	3.3	100	nw.	10	4.5	2,905	886	49.5	9.7	....	wnw.	......	......
6:36 p. m.	38.0	3.3	100	nw.	8	3.6	2,161	659	50.9	10.5	....	wnw.	......	......
6:44 p. m.	38.0	3.3	100	nw.	8	3.6	1,725	526	38.0	3.3	100	nw.	8	3.6

February 11, 1908.—Five kites were used; lifting surface, 346 sq. ft. (32.0 sq. m.). Wire out, 17,000 ft. (5,182 m.); at maximum altitude, 14,000 ft. (4,267 m.).

During the flight the sky was overcast with St. from the west. The head kite disappeared into the clouds at 10:39 a. m. at an altitude of 5,762 ft. (1,756 m.), and was visible only at intervals until 1:25 p. m., when it fell below the cloud level at an elevation of 5,089 ft. (1,551 m.).

High pressure, central over New York, covered the eastern United States.

February 12, 1908.—Five kites were used; lifting surface, 346 sq. ft. (32.0 sq. m.). Wire out, 25,000 ft. (7,620 m.); at maximum altitude, 20,000 ft. (6,096 m.).

St.-Cu. from the southwest obscured the sky until near the end of the flight, when St. clouds from the same direction prevailed. The head kite entered St.-Cu. at 8:10 a. m. at an elevation of 5,413 ft. (1,650 m.) in ascending. In the descent the kite emerged from St. clouds only 500 ft. (142 m.) above the ground.

The barometer was high over New England, while an area of low pressure occupied the Missouri Valley.

February 13, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 5,000 ft. (1,524 m.); at maximum altitude, 4,200 ft. (1,280 m.).

Dense fog prevailed during most of the flight. Light rain fell after 5 p. m.

High pressure, central over New England, extended westward over the Allegheny Mountains. Low pressure was centered north of Lake Superior.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.					Miles	Met's							Miles	Met's
Feb. 14:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
10:17 a. m.	37.0	2.8	100	se.	12	5.4	1,725	526	37.0	2.8	100	se.	12	5.4
10:38 a. m.	36.0	2.2	100	se.	12	5.4	2,864	878	55.4	13.0	....	s.	......	......
10:52 a. m.	36.0	2.2	100	se.	13	5.8	4,578	1,395	50.2	10.1	....	sw.	......	......
11:30 a. m.	36.0	2.2	100	se.	12	5.4	6,563	2,000	45.3	7.4	....	sw.	......	......
11:39 a. m.	36.5	2.5	100	se.	14	6.3	8,263	2,519	40.1	4.5	....	sw.	......	......
12:33 p. m.	34.5	1.4	100	se.	13	5.8	10,822	3,298	31.8	− 0.1	....	sw.	......	......
12:55 p. m.	34.1	2.2	100	se.	13	5.8	11,669	3,557	20.0	− 4.0	....	sw.	......	......
1:35 p. m.	35.8	2.1	100	s.	12	5.4	8,728	2,660	32.5	0.3	....	sw.	......	......
1:59 p. m.	38.0	3.3	100	s.	12	5.4	1,725	526	38.0	3.3	100	s.	12	5.4
Feb. 15:														
12:06 p. m.	47.2	8.4	67	nw.	36	16.1	1,725	526	47.2	8.4	67	nw.	36	16.1
12:10 p. m.	47.2	8.4	67	nw.	36	16.1	2,946	898	41.7	5.4	....	wnw.	......	......
12:17 p. m.	47.1	8.4	66	nw.	35	15.6	3,409	1,039	43.5	6.4	....	wnw.	......	......
12:25 p. m.	47.7	8.7	64	nw.	34	15.2	3,682	1,122	46.8	8.2	....	w.	......	......
12:30 p. m	47.8	8.8	62	nw.	35	15.6	4,834	1,473	43.9	6.6	....	wsw.	......	......
12:36 p. m.	47.6	8.7	66	nw.	31	13.9	4,162	1,269	42.1	5.6	....	sw.	......	......
12:50 p. m.	47.6	8.7	62	nw.	33	14.8	3,270	997	42.6	5.9	....	sw.	......	......
1:17 p. m.	46.3	7.9	50	nw.	35	15.6	1,725	526	46.3	7.9	50	nw.	35	15.6
Feb. 17:														
7:40 a. m.	19.0	− 7.2	57	wnw.	9	4.0	1,725	526	19.0	− 7.2	57	wnw.	9	4.0
8:00 a. m.	20.0	− 6.7	66	nw.	12	5.4	2,820	860	14.7	− 9.6	....	wnw.	......	......
8:30 a. m.	21.0	− 6.1	71	nw.	18	8.0	4,652	1,418	6.4	−14.2	....	nw.	......	......
9:08 a. m.	21.2	− 6.0	64	w.	18	8.0	6,191	1,887	− 0.9	−18.3	....	wnw.	......	......
9:40 a. m.	21.3	− 5.9	55	nw.	17	7.6	7,744	2,360	− 5.3	−20.7	....	wnw.	......	......
11:05 a. m.	22.5	− 5.3	52	nw.	28	12.5	10,046	3,062	− 2.2	−19.0	....	wnw.	......	......
11:40 a. m.	23.5	− 4.7	42	nw.	29	13.0	12,800	3,902	− 9.4	−23.0	....	nw.	......	......
12:38 p. m.	23.5	− 4.7	45	nw.	27	12.1	10,002	3,048	− 2.6	−19.2	....	nw.	......	......
12:55 p. m.	24.0	− 4.4	46	nw.	28	12.5	7,752	2,363	7.2	−13.8	....	wnw.	......	......
1:00 p. m.	24.0	− 4.4	49	nw.	28	12.5	6,635	2,022	− 0.4	−18.0	....	wnw.	......	......
1:11 p. m.	22.9	− 5.1	56	nw.	28	12.5	5,376	1,638	2.5	−16.4	....	wnw.	......	......
1:24 p. m.	23.9	− 4.5	56	nw.	24	10.7	3,949	1,204	10.8	−11.8	....	wnw.	......	......
1:36 p. m.	23.3	− 4.8	56	nw.	24	10.7	2,845	867	16.2	− 8.8	....	nw.	......	......
1:41 p. m.	24.5	− 4.2	41	nw.	22	9.8	1,725	526	24.5	− 4.2	41	nw.	22	9.8

February 14, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude, 19,000 ft. (5,791 m.).

Dense fog prevailed during the flight.

An active low was central over Arkansas, and rain was general east of the Mississippi. Pressure was relatively high over New England.

February 15, 1908.—Two kites were used; lifting surface, 87 sq. ft. (8.1 sq. m.). Wire out, 9,000 ft. (2,743 m.); at maximum altitude, 8,000 ft. (2,438 m.).

From 3/10 to 7/10 of the sky was covered with St.-Cu. from the southwest until 1 p. m., from the west thereafter.

Very low pressure was central over Lake Ontario at 8 a. m., and rain was falling from North Carolina northward.

February 17, 1908.—Six kites were used; lifting surface, 414 sq. ft. (38.3 sq. m.). Wire out, 25,000 ft. (7,620 m.); at maximum altitude, 22,500 ft. (6,858 m.).

St.-Cu. moving rapidly from the west-northwest varied in amount from 1/10 at the beginning to 9/10 at the end of the flight. Early in the flight the altitude of the cloud bases was about 4,160 ft. (1,268 m.); later they were about 5,376 ft. (1,638 m.). Light snow fell from 10:10 to 10:30 a. m.

Pressure was high over the Mississippi Valley and low over New York.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Feb. 18:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:01 p. m.	27.0	— 2.8	53	s.	11	4.9	1,725	526	27.0	— 2.8	53	s.	11	4.9
1:20 p. m.	27.3	— 2.6	53	se.	11	4.9	2,475	754	19.4	— 7.0	....	s.	......	......
1:38 p. m.	27.3	— 2.6	53	se.	11	4.9	3,336	1,017	15.3	— 9.3	....	s.	......	......
2:03 p. m.	27.5	— 2.5	54	s.	12	5.4	4,003	1,220	15.1	— 9.4	....	s.	......	......
3:20 p. m.	27.5	— 2.5	55	se.	13	5.8	5,293	1,613	21.6	— 5.8	....	sw.	......	......
3:28 p. m.	27.5	— 2.5	55	se.	13	5.8	4,118	1,254	18.5	—10.3	....	sw.	......	......
3:46 p. m.	28.0	— 2.2	66	se.	12	5.4	3,067	935	18.9	— 7.3	....	s.	......	......
3:51 p. m.	27.7	— 2.4	66	se.	12	5.4	1,725	526	27.7	— 2.4	66	se.	12	5.4
Feb. 19:														
7:45 a. m.	23.0	— 5.0	100	se.	13	5.8	1,725	526	23.0	— 5.0	100	se.	13	5.8
8:06 a. m.	24.0	— 4.4	100	se.	15	6.7	2,638	804	23.5	— 4.7	....	se.	......	......
8:15 a. m	24.0	— 4.4	100	se.	14	6.3	3,442	1,049	27.1	— 2.7	....	sse.	......	......
8:25 a. m.	24.0	— 4.4	100	se.	15	6.7	4,197	1,279	28.9	— 1.7	....	s.	......	......
8:47 a. m.	24.5	— 4.2	100	se.	16	7.2	5,043	1,537	28.4	— 2.0	....	s.	......	......
9:02 a. m.	24.8	— 4.0	100	se.	16	7.2	5,995	1,828	27.1	— 2.7	....	s.	......	......
9:27 a. m.	25.4	— 3.7	100	e.	15	6.7	6,141	1,872	27.7	— 2.4	....	s.	......	......
10:20 a. m.	27.2	— 2.7	100	e.	12	5.4	4,367	1,330	30.6	— 0.8	....	s.	......	......
10:38 a. m.	28.5	— 1.9	100	e.	15	6.7	1,725	526	28.5	— 1.9	100	e.	15	6.7
Feb. 20:														
1:45 p. m.	24.9	— 3.9	63	nw.	45	20.1	1,725	526	24.9	— 3.9	63	nw.	45	20.1
1:50 p. m.	25.0	— 3.9	63	nw.	40	17.9	2,818	857	19.2	— 7.1	....	nw.	......	......
2:00 p. m.	25.0	— 3.9	63	nw.	44	19.7	3,567	1,087	16.9	— 8.4	....	nw.	......	......
2:06 p. m.	25.0	— 3.9	63	nw.	45	20.1	4,095	1,248	17.6	— 8.0	....	nw.	......	......
2:12 p. m.	25.6	— 3.6	56	nw.	45	20.1	4,564	1,391	24.1	— 4.4	....	n.	......	......
2:26 p. m.	25.6	— 3.6	56	nw.	46	20.6	5,029	1,533	26.1	— 3.3	....	n.	......	......
2:47 p. m.	25.6	— 3.6	57	nw.	47	21.0	4,495	1,370	18.3	— 7.6	....	n.	......	......
3:04 p. m.	26.0	— 3.3	64	nw.	47	21.0	3,525	1,074	17.6	— 8.0	....	nnw.	......	......
3:13 p. m.	26.0	— 3.3	64	nw.	47	21.0	2,755	834	20.1	— 6.6	...	nw.	......	......
3:25 p. m.	26.0	— 3.3	64	nw.	46	20.6	1,725	526	26.0	— 3.3	64	nw.	46	20.6

February 18, 1908.—Four kites were used; lifting surface, 142 sq. ft. (25.7 sq. m.). Wire out, 10,000 ft. (3,048 m.); at maximum altitude, 6,500 ft. (1,981 m.).

Ci. from the west were present during the flight in amounts averaging about 1/10 before 2:30 p. m. and 8/10 thereafter.

An active low was central over Arkansas at 8 a. m., while the barometer was high over the Middle Atlantic States.

February 19, 1908.—Two kites were used; lifting surface, 87 sq. ft. (8.1 sq. m.). Wire out, 15,000 ft. (4,572 m.) at the maximum altitude.

Dense fog prevailed thruout the flight and light snow gave place to rain and sleet at 9:50 a. m.

A storm area was central over Ohio, while pressure was high over Nova Scotia, and rain or snow was falling over the greater part of the eastern United States.

February 20, 1908.—Two kites were used; lifting surface, 87 sq. ft. (8.1 sq. m.). Wire out, 10,000 ft. (3,048 m.) at the maximum altitude.

A few St.-Cu. from the north-northwest were present during the flight.

An area of low pressure was passing eastward over the Maine coast at 8 a. m. and high pressure was central over Louisiana.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Feb. 21:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:36 a. m.	19.0	— 7.2	69	w.	16	7.2	1,725	526	19.0	— 7.2	69	w.	16	7.2
7:57 a. m.	20.0	— 6.7	60	w.	18	8.0	2,605	794	27.5	— 2.5	....	w.	......	......
8:28 a. m.	25.4	— 8.7	52	sw.	15	6.7	8,567	1,087	80.0	— 1.1	....	w.	......	......
8:41 a. m.	28.0	— 2.2	44	sw.	11	4.9	5,885	1,626	23.9	— 4.5	.. .	wsw.	......	......
8:58 a. m.	28.0	— 2.2	88	sw.	7	8.1	7,222	2,201	23.5	— 4.7	....	wsw.	......	......
9:30 a. m.	28.3	— 2.1	41	sw.	6	2.7	9,378	2,858	17.6	— 8.0	....	wsw.	......	......
10:20 a. m.	27.4	— 2.6	47	w.	5	2.2	10,405	8,172	14.5	— 9.7	....	wsw.	......	......
11:53 a. m.	81.0	— 0.6	50	se.	6	2.7	11,784	8,592	10.4	—12.0	....	wsw.	......	......
12:32 p. m.	81.3	— 0.4	50	s.	4	1.8	10,250	8,124	14.0	—10.0	....	wsw.	......	......
12:51 p. m.	34.0	1.1	49	se.	6	2.7	9,929	8,026	17.2	— 8.2	....	w.	......	......
1:07 p. m.	34.0	1.1	47	se.	7	3.1	7,240	2,207	24.8	— 4.0	....	w.	......	......
1:28 p. m.	88.0	0.6	47	se.	7	8.1	4,798	1,462	28.4	— 2.0	....	w.	......	......
1:26 p. m.	33.0	0.6	47	se.	7	8.1	3,767	1,148	25.3	— 8.7	....	w.	......	......
1:36 p. m.	32.0	0.0	48	se.	8	3.6	1,725	526	32.0	0.0	48	se.	8	3.6
Feb. 22:														
7:36 a. m.	19.4	— 7.0	55	nw.	25	11.2	1,725	526	19.4	— 7.0	55	nw.	25	11.2
7:45 a. m.	18.5	— 7.5	61	nw.	25	11.2	2,887	865	12.4	—10.9	....	wnw.	......	......
8:00 a. m.	18.4	— 7.6	61	nw.	26	11.6	8,606	1,099	8.6	—18.0	....	nw.	......	......
8:16 a. m.	18.4	— 7.6	62	nw.	25	11.2	4,841	1,476	3.2	—16.0	....	nw.	......	......
8:32 a. m.	18.8	— 7.3	61	nw.	28	12.5	6,611	2,015	— 4.0	—20.0	....	nw.	......	......
8:38 a. m.	18.8	— 7.3	60	nw.	29	13.0	6,946	2,117	1.8	—16.8	....	nw.	......	......
9:06 a. m.	19.0	— 7.2	63	nw.	30	13.4	9,234	2,814	— 1.8	—18.5	....	nw.	......	......
9:49 a. m.	19.5	— 6.9	67	nw.	34	15.2	10,847	8,154	— 2.9	—19.4	....	nw.	......	......
10:16 a. m.	20.2	— 6.6	68	nw.	33	14.8	8,652	2,637	— 0.8	—18.2	....	nw.	......	......
10:27 a. m.	19.4	— 7.0	63	nw.	28	12.5	7,124	2,171	4.1	—15.5	....	hw.	......	......
10:39 a. m.	19.8	— 7.1	74	nw.	26	11.6	6,006	1,831	— 0.8	—18.2	....	nw.	......	......
11:03 a. m.	19.7	— 6.8	76	nw.	24	10.7	5,013	1,528	3.2	—16.1	....	nw.	......	......
11:12 a. m.	20.5	— 6.4	70	nw.	24	10.7	8,215	980	11.3	—11.5	....	nw.	......	......
11:22 a. m.	21.1	— 6.1	70	nw.	22	9.8	2,726	831	14.2	— 9.9	...	nw.	......	......
11:26 a. m.	21.5	— 5.8	64	nw.	24	10.7	1,725	526	21.5	— 5.8	64	nw.	24	10.7
Feb. 24:														
7:58 a. m.	20.0	— 6.7	85	nnw.	12	5.4	1,725	526	20.0	— 6.7	85	nnw.	12	5.4
8:10 a. m.	20.2	— 6.7	85	nw.	15	6.7	2,857	871	15.4	— 9.2	....	nnw.	......	......
8:20 a. m.	19.6	— 6.9	85	nw.	17	7.6	8,965	1,209	11.1	—11.6	....	nnw.	......	......
8:34 a. m.	19.7	— 6.8	85	nw.	5	2.2	5,374	1,638	8.9	—15.6	....	nnw.	......	......
10:15 a. m.	22.6	— 5.2	75	n.	6	2.7	4,368	1,330	8.6	—13.0	....	nnw.	......	......
10:45 a. m.	22.7	— 5.2	81	n.	6	2.7	8,408	1,039	13.5	—10.8	. ..	nw.	......	......
11:43 a. m.	24.7	— 4.1	73	nw.	7	8.1	1,725	526	24.7	— 4.1	73	nw.	7	3.1

February 21, 1908.—Five kites were used; lifting surface, 340 sq. ft. (31.5 sq. m.). Wire out, 19,000 ft. (5,791 m.) at the maximum altitude.

At the beginning of the flight 2/10 Ci. from the west were seen, but after 9 a. m., 8/10 or more Ci.-St., also from the west, were present.

Pressure was low over the upper Lakes, and was high over the Gulf States.

February 22, 1908.—Four kites were used; lifting surface, 213 sq. ft. (19.8 sq.m.). Wire out, 22.000 ft. (6,706 m.); at maximum altitude, 20,500 ft. (6,248 m.).

At the beginning of the flight 8/10 Ci. from the west were observed. About 8 a. m. St.-Cu. from the northwest appeared, and were present until the end of the flight in amounts varying from 1/10 to 9/10. Light snow flurries occurred between 9:10 and 10:45 a. m. The last 3,500 ft. (1.067 m.) of wire to come in was lightly coated with frost.

Centers of low pressure lay over Maine and over Minnesota, while the barometer was high over Texas.

February 24, 1908.—One kite was used; lifting surface, 68 sq. ft. (6.3 sq. m.). Wire out, 6,000 ft. (1,829 m.); at maximum altitude, 5,000 ft. (1,524 m.).

St.-Cu. from the northwest varied in amount from 6/10 to 10/10 until after 11 a. m., then decreased to 4/10. Light snow fell from 7:41 to 8:10, and from 8:55 to 10:45 a. m.

High pressure, central north of the lower Lakes, occupied the country east of the Mississippi, while pressure was low east of New England.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. Feb. 25:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:59 a. m.	20.5	− 6.4	78	se.	14	6.3	1,725	526	20.5	− 6.4	78	se.	14	6.3
8:07 a. m.	20.6	− 6.3	77	se.	14	6.3	2,830	863	16.2	− 8.8	....	s.	......	......
8:22 a. m.	21.0	− 6.1	75	se.	16	7.2	3,867	1,179	18.0	− 7.8	....	ssw.	......	......
8:32 a. m.	22.5	− 5.3	72	se.	16	7.2	5,402	1,647	22.1	− 5.5	....	sw.	......	......
8:55 a. m.	22.5	− 5.3	72	se.	15	6.7	6,220	1,896	29.1	− 1.6	....	sw.	......	......
9:12 a. m.	23.0	− 5.0	76	se.	16	7.2	7,900	2,408	27.5	− 2.5	....	sw.	......	......
9:39 a. m.	24.8	− 4.0	77	se.	20	8.9	9,423	2,872	20.8	− 6.2	...	sw.	......	......
10:01 a. m.	25.0	− 3.9	75	se.	19	8.5	11,299	3,444	17.6	− 8.0	....	sw.	......	......
10:30 a. m.	25.3	− 3.7	75	se.	18	8.0	14,751	4,496	10.6	−11.9	....	sw.	......	......
10:54 a. m.	25.6	− 3.6	75	se.	23	10.3	12,349	3,764	16.7	− 8.5	....	sw.	......	......
11:05 a. m.	25.3	− 3.7	75	se.	21	9.4	9,486	2,891	23.7	− 4.6	....	sw.	......	......
11:35 a. m.	26.2	− 3.2	74	se.	18	8.0	7,958	2,426	26.6	− 3.0	....	sw.	......	......
11:53 a. m.	26.3	− 3.2	75	se.	21	9.4	5,924	1,805	26.6	− 3.0	....	sw.	......	......
12:06 p. m.	26.0	− 3.3	77	se.	25	11.2	5,064	1,544	32.0	0.0	....	sw.	......	......
12:19 p. m.	26.0	− 3.3	77	se.	24	10.7	3,776	1,151	21.2	− 6.0	....	s.	......	......
12:26 p. m.	26.8	− 2.9	78	se.	25	11.2	2,839	865	18.5	− 7.5	...	sse.	......	......
12:35 p. m.	26.8	− 2.9	78	se.	23	10.3	1,725	526	26.8	− 2.9	78	se.	23	10.3
Feb. 26:														
1:20 p. m.	37.7	3.2	53	nw.	28	12.5	1,725	526	37.7	3.2	53	nw.	28	12.5
1:27 p. m.	38.0	3.3	51	nw.	30	13.4	2,763	842	32.2	0.1	....	wnw.	......	......
1:44 p. m.	38.8	3.8	52	nw.	26	11.6	3,709	1,131	27.9	− 2.3	....	wnw.	......	.....
2:03 p. m.	38.5	3.6	51	nw.	26	11.6	4,918	1,499	20.5	− 6.4	....	wnw.	......	......
2:15 p. m.	38.5	3.6	51	nw.	27	12.1	5,800	1,768	23.0	− 5.0	....	w.	.....	......
2:45 p. m.	39.4	4.1	49	nw.	20	8.9	8,828	2,691	13.5	−10.3	....	wsw.	......	......
3:12 p. m.	39.2	4.0	48	nw.	16	7.2	10,423	3,177	7.0	−13.9	....	wsw.	......	......
3:33 p. m.	40.0	4.4	47	nw.	14	6.3	11,841	3,609	1.4	−17.0	....	sw.	......	......
3:50 p. m.	40.8	4.9	48	nw.	11	4.9	13,017	3,968	− 3.8	−19.9	....	sw.	......	......
4:45 p. m.	40.6	4.8	46	w.	9	4.0	10,251	3,125	5.5	−14.7	....	sw.	......	......
5:04 p. m.	40.0	4.4	46	w.	6	2.7	8,931	2,722	9.5	−12.5	....	wsw.	......	......
5:12 p. m.	40.0	4.4	46	w.	11	4.9	8,539	2,603	6.3	−14.3	....	wsw.	......	......
5:20 p. m.	38.8	3.8	47	w.	10	4.5	4,727	1,441	21.4	− 5.9	....	wsw.	......	......
7:00 p. m.	37.6	3.1	55	nw.	18	5.8	1,725	526	37.6	3.1	55	nw.	18	5.8

February 25, 1908.—Four kites were used; lifting surface, 272 sq. ft. (25.2 sq. m.). Wire out, 25,000 ft. (7,620 m.) at the maximum altitude.

From 6/10 to 10/10 of Ci., Ci.-St., and Ci.-Cu., moving from the west were followed after 11:45 a. m. by about 9/10 of A.-St., also from the west. Some St. from the southeast were present during the latter half of the flight.

Low pressure, central over Lake Michigan, occupied the Mississippi Valley; while high pressure, central over Nova Scotia, extended southward along the coast.

February 26, 1908.—Five kites were used; lifting surface, 330 sq. ft. (30.6 sq. m.). Wire out, 28,000 ft. (8,534 m.) at the maximum altitude.

St. from the west-northwest were present in amounts ranging from 1/10 before 3.30 p. m. to 5/10 or more after 5.30 p. m.

A disturbance was central over Lake Huron, with a secondary low reaching down into Virginia, while pressure was high over Nova Scotia.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
1908. Feb. 27:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:34 a.m.	26.7	− 2.9	76	nw.	20	8.9	1,725	526	26.7	− 2.9	76	nw.	20	8.9
7:48 a.m.	26.9	− 2.8	75	nw.	18	8.0	2,784	849	24.1	− 4.4	....	nw.	......	......
8:05 a.m.	26.8	− 2.9	74	nw.	22	9.8	3,562	1,086	22.8	− 5.4	....	nw.	......	......
8:20 a.m.	27.3	− 2.6	73	nw.	25	11.2	4,340	1,323	23.5	− 4.7	....	w.	......	......
8:51 a.m.	28.0	− 2.2	66	nw.	26	11.6	5,357	1,633	18.5	− 7.5	....	wsw.	......	......
9:40 a.m.	28.4	− 2.0	68	nw.	23	10.8	6,140	1,871	13.6	−10.2	....	wsw.	......	......
10:27 a.m.	29.6	− 1.3	61	nw.	26	11.6	7,293	2,223	7.7	−13.5	....	sw.	......	......
10:53 a.m.	29.0	− 1.7	61	nw.	17	7.6	5,968	1,819	11.3	−11.5	....	nw.	......	......
11:03 a.m.	29.0	− 1.7	61	nw.	18	8.0	5,031	1,534	15.1	− 9.4	....	nw.	......	......
11:18 a.m.	29.0	− 1.7	61	nw.	18	8.0	3,951	1,204	18.1	− 7.7	....	nw.	......	......
1:00 p.m.	30.3	− 0.9	76	nw.	17	7.6	2,681	817	33.9	− 4.5	....	nw.	......	......
1:26 p.m.	30.0	− 1.1	80	nw.	16	7.2	1,725	526	30.0	− 1.1	80	nw.	16	7.2
Feb. 28:														
10:45 a.m.	18.8	− 7.3	64	nw.	22	9.8	1,725	526	18.8	− 7.3	64	nw.	22	9.8
10:51 a.m.	18.0	− 7.8	60	nw.	21	9.4	2,888	880	12.2	−11.0	....	wnw.	......	......
11:02 a.m.	18.0	− 7.8	56	nw.	22	9.8	3,980	1,213	6.6	−14.1	....	wnw.	......	......
11:33 a.m.	20.0	− 6.7	58	nw.	26	11.6	4,559	1,390	6.8	−14.3	....	wnw.	......	......
11:43 a.m.	19.8	− 6.8	59	nw.	33	14.8	3,298	1,005	10.8	−11.8	....	wnw.	......	......
11:52 a.m.	19.8	− 6.8	59	nw.	32	14.3	2,871	875	14.4	− 9.8	....	wnw.	......	......
12:01 p.m.	20.0	− 6.7	62	nw.	34	15.2	1,725	526	20.0	− 6.7	62	nw.	34	15.2
Feb. 29:														
7:09 a.m.	20.5	− 6.4	70	nw.	11	4.9	1,725	526	20.5	− 6.4	70	nw.	11	4.9
7:20 a.m.	20.4	− 6.4	78	nw.	10	4.5	2,667	813	20.3	− 6.5	....	nw.	......	......
7:33 a.m.	20.5	− 6.4	78	nw.	9	4.0	3,277	999	21.0	− 6.1	....	nw.	......	......
8:02 a.m.	20.6	− 6.3	77	nw.	5	2.2	3,847	1,173	22.5	− 5.3	....	nw.	......	......
9:12 a.m.	25.0	− 3.9	63	nw.	2	0.9	3,278	999	20.5	− 6.5	....	nw.	......	......
9:18 a.m.	25.5	− 3.6	67	nw.	2	0.9	1,725	526	25.5	− 3.6	67	nw.	2	0.9

February 27, 1098.—Four kites were used; lifting surface, 272 sq. ft. (25.2 sq. m.). Wire out, 13,150 ft. (4,008 m.) at the maximum altitude.

A few Ci.-St., Ci.-Cu., A.-Cu., and St.-Cu. moving from the southwest were observed before 10 a. m. Lower clouds then increased, coming first from the west-northwest, later from the northwest, and had overcast the sky by 1 p. m. Light snow began at 2:15 p. m.

Low pressure was central off Rhode Island and snow was falling from Virginia and Tennessee northward. High pressure was central over Lake Winnipeg.

February 28, 1908.—Two kites were used; lifting surface, 105 sq. ft. (9.8 sq. m.). Wire out, 6,000 ft. (1,829 m.); at maximum altitude, 5,500 ft. (1,676 m.).

A few St. from the west-northwest were visible during the flight.

Pressure was low over the lower St. Lawrence, and a ridge of high pressure extended from the Gulf to eastern Kentucky.

February 29, 1908.—Two kites were used; lifting surface, 142 sq. ft. (13.1 sq. m.). Wire out, 4,000 ft. (1,219 m.) at the maximum altitude.

A few Ci.-Cu. moving from the west and A.-St. from the northwest were visible until about 8:15 a. m. A few Ci.-St. moving from the west were observed thereafter.

Pressure was low over Nova Scotia and high over the Lakes and southward along the coast.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.						
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.	
				Dir.	Velocity.							Dir.	Velocity.
1908. March 2:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:21 a. m.	52.5	11.4	52	sw.	18	8.0	1,725	526	52.5	11.4	52	sw.	18	8.0
7:25 a. m.	52.7	11.5	53	sw.	16	7.2	2,890	881	53.6	12.0	....	wsw.	......	......
7:40 a. m.	52.6	11.4	53	sw.	16	7.2	4,030	1,228	50.0	10.0	....	w.	......	......
7:50 a. m.	52.8	11.6	50	sw.	16	7.2	4,982	1,518	44.2	6.8	....	w.	......	......
7:58 a. m.	52.0	11.1	52	w.	17	7.6	5,918	1,804	40.6	4.8	....	w.	......	......
8:06 a. m.	51.0	10.6	54	w.	17	7.6	6,776	2,065	42.8	6.0	....	w.	......	......
8:15 a. m.	48.6	9.2	61	w.	16	7.2	7,794	2,376	38.1	3.4	....	wsw.	......	......
9:06 a. m.	52.1	11.2	56	sw.	19	8.5	9,170	2,795	32.2	0.1	....	wsw.	......	......
9:27 a. m.	52.0	11.1	58	sw.	18	8.0	6,865	2,092	42.1	5.6	....	w.	......	......
9:50 a. m.	53.5	11.9	54	sw.	18	8.0	6,259	1,908	42.8	6.0	....	w.	......	......
10:04 a. m.	53.0	11.7	56	sw.	20	8.9	5,018	1,530	46.8	8.2	....	wnw.	......	......
10:19 a. m.	53.7	12.1	53	sw.	13	5.8	3,817	1,163	50.4	10.2	....	wnw.	......	......
10:28 a. m.	53.2	11.8	53	sw.	13	5.8	2,889	881	51.8	11.0	....	w.	......	......
10:35 a. m.	53.3	11.8	56	sw.	12	5.4	1,728	526	53.3	11.8	56	sw.	12	5.4
March 3:														
7:40 a. m.	30.0	— 1.1	76	nw.	22	9.8	1,725	526	30.0	— 1.1	76	nw.	22	9.8
7:45 a. m.	30.3	— 0.9	75	nw.	27	12.1	2,820	860	26.6	— 3.0	....	nw.	......	......
7:54 a. m.	30.8	— 0.7	71	nw.	26	11.6	3,645	1,111	23.2	— 4.9	....	nw.	......	......
8:02 a. m.	30.8	— 0.7	71	nw.	26	11.6	4,914	1,498	34.0	1.1	....	nw.	......	......
8:44 a. m.	31.5	— 0.8	69	nw.	16	7.2	7,289	2,222	29.5	— 1.4	....	wnw.	......	......
9:45 a. m.	32.5	0.3	62	nw.	26	11.6	8,232	2,509	26.1	— 3.3	....	wnw.	......	......
9:56 a. m.	33.0	0.6	61	nw.	32	14.3	10,112	3,082	17.8	— 7.9	....	wnw.	......	......
10:27 a. m.	33.0	0.6	61	nw.	27	12.1	12,006	3,659	10.2	—12.1	....	wnw.	......	......
11:20 a. m.	34.6	1.4	55	nw.	26	11.6	11,364	3,464	11.5	—11.4	....	wnw.	......	......
11:54 a. m.	35.8	2.1	55	nw.	22	9.8	8,486	2,579	24.1	— 4.4	....	wnw.	......	......
12:29 p. m.	37.0	2.8	58	nw.	23	10.8	5,052	1,540	39.4	4.1	....	wnw.	......	......
12:44 p. m.	37.4	3.0	57	nw.	24	10.7	3,653	1,118	38.5	3.6	....	nw.	......	......
12:50 p. m.	37.8	3.2	56	nw.	25	11.2	3,504	1,068	29.5	— 1.4	....	nw.	......	......
1:06 p. m.	38.1	3.4	55	nw.	24	10.7	1,725	526	38.1	3.4	55	nw.	24	10.7
March 4:														
7:15 a. m.	25.0	— 3.9	75	e.	9	4.0	1,725	526	25.0	— 3.9	75	e.	9	4.0
8:35 a. m.	26.0	— 3.3	75	se.	12	5.4	2,360	719	24.6	— 4.1	....	s.	......	......
10:35 a. m.	26.0	— 3.3	75	se.	7	3.1	1,725	526	26.0	— 3.3	75	se.	7	3.1

March 2, 1908.—Four kites were used; lifting surface, 272 sq. ft. (25.2 sq. m.). Wire out, 17,000 ft. (5,182 m.); at maximum altitude, 16,500 ft. (5,029 m.).

During the flight the sky was overcast with A.-St., direction indeterminable, and with St.-Cu. moving from the west-southwest.

Low pressure was central over Lake Ontario, high pressure over Nova Scotia.

March 3, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 25,000 ft. (7,620 m.); at maximum altitude, 21,000 ft. (6,401 m.).

During the flight the sky was partly covered with Ci. moving from the west. A few St. from the west-northwest were seen at 11:20 a. m.

High pressure, central over the Lake region, occupied the greater part of the country. Pressure was relatively low over northern New England.

March 4, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 3,000 ft. (914 m.); at maximum altitude.

During the flight the sky was partly covered with Ci. moving from the northwest and A.-Cu. from the west-northwest.

High pressure covered the United States, except the southwest.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
1908.					Miles	Met's							Miles	Met's
March 5:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters	° F.	° C.	%		p. h.	p. s.
7:03 a. m.	26.8	— 2.9	86	se.	8	3.6	1,725	526	26.8	— 2.9	86	se.	8	3.6
7:15 a. m.	27.1	— 2.7	87	se.	8	3.6	2,705	824	30.6	— 0.8	....	ssw.	......	......
7:40 a. m.	27.8	— 2.8	83	se.	11	4.9	2,807	856	32.0	0.0	....	sw.	......	......
7:50 a. m.	27.2	— 2.7	83	se.	11	4.9	3,689	1,124	30.7	— 0.7	....	sw.	......	......
8:01 a. m.	27.4	— 2.6	82	se.	13	5.8	5,820	1,774	28.4	— 2.0	....	wsw.	......	......
8:27 a. m.	28.6	— 1.9	78	se.	13	5.8	7,238	2,206	23.0	— 5.0	....	w.	......	......
9:12 a. m.	28.7	— 1.8	75	se.	13	5.8	8,594	2,620	19.4	— 7.0	....	w.	......	......
11:07 a. m.	30.7	— 0.7	79	se.	14	6.3	9,134	2,784	19.6	— 6.9	....	w.	......	......
12:58 p. m.	34.0	1.1	72	se.	14	6.3	7,704	2,348	24.8	— 4.0	....	w.	......	......
1:10 p. m.	33.4	0.8	70	se.	14	6.3	6,416	1,956	29.8	— 1.2	....	w.	......	......
1:32 p. m.	33.6	0.9	77	se.	15	6.7	4,956	1,511	33.1	0.6	....	wsw	......	......
1:40 p. m	33.0	0.6	77	se.	14	6.3	3,935	1,199	30.6	— 0.8	....	wsw.	......	......
1:48 p. m.	33.0	0.6	80	se.	16	7.2	2,828	862	25.7	— 3.5	....	ssw.	......	......
1:52 p. m.	32.5	0.3	75	se.	14	6.3	1,725	526	32.5	0.3	75	se.	14	6.3
March 6:														
1:19 p. m.	31.0	— 0.6	100	se.	21	9.4	1,725	526	31.0	— 0.6	100	se.	21	9.4
1:40 p. m.	31.0	— 0.6	100	se.	20	8.9	3,202	976	50.4	10.2	....	ssw.	......	......
2:25 p. m.	31.3	— 0.4	100	se.	16	7.2	4,063	1,238	55.8	13.2	....	ssw.	......	......
3:16 p. m.	32.0	0.0	100	se.	18	8.0	6,053	1,845	48.6	9.2	....	wsw.	......	......
3:28 p. m.	32.0	0.0	100	se.	17	7.6	7,206	2,196	54.0	12.2	....	w.	......	......
3:43 p. m.	32.0	0.0	100	se.	15	6.7	6,135	1,870	50.0	10.0	....	w.	......	......
3:55 p. m.	32.0	0.0	100	se.	18	8.0	4,745	1,446	55.8	13.2	....	sw.	......	......
4:07 p. m.	32.0	0.0	100	se.	17	7.6	3,314	1,010	58.5	14.7	....	ssw.	......	......
4:35 p. m.	32.0	0.0	100	se.	15	6.7	1,725	526	32.0	0.0	100	se.	15	6.7
March 7:														
1:25 p. m.	54.4	12.4	42	nw.	30	13.4	1,725	526	54.4	12.4	42	nw.	30	13.4
1:33 p. m.	54.6	12.6	44	nw.	30	13.4	2,763	842	49.5	9.7	....	wnw.	......	......
1:42 p. m.	55.0	12.8	44	nw.	27	12.1	3,749	1,143	44.8	7.1	....	w.	......	......
2:09 p. m.	53.9	12.2	46	nw.	25	11.2	6,285	1,916	38.8	3.5	....	w.	......	......
2:19 p. m.	53.4	11.9	48	nw.	26	11.6	7,071	2,156	39.2	4.0	....	w.	......	......
2:33 p. m.	53.0	11.7	47	nw.	23	10.3	8,065	2,458	40.6	4.8	....	w.	......	......
3:15 p. m.	52.5	11.4	48	nw.	24	10.7	7,072	2,156	35.1	1.7	....	w.	......	......
3:38 p. m.	51.7	10.9	50	nw.	27	12.1	5,495	1,675	39.6	4.2	....	w.	......	......
3:52 p. m.	51.0	10.6	49	nw.	24	10.7	4,769	1,454	42.8	6.0	....	w.	......	......
4:03 p. m.	51.0	10.6	48	nw.	20	8.9	3,831	1,168	43.0	6.1	....	wnw.	......	......
4:13 p. m.	50.5	10.3	48	nw.	24	10.7	2,726	831	44.1	6.7	....	nw.	......	......
4:17 p. m.	50.1	10.1	50	nw.	25	11.2	1,725	526	50.1	10.1	50	nw.	25	11.2

March 5, 1908.—Seven kites were used; lifting surface, 487 sq. ft. (45.1 sq. m.). Wire out, 25,000 ft. (7,620 m.) at the maximum altitude, 17,200 ft. (5,243 m.).

St.-Cu. moving from the southwest covered the sky until after 8 a. m. At 8:27 a. m. 4/10 A.-St. and 6/10 St.-Cu. were moving from the west. After 11 a. m. the sky was overcast with St.-Cu. moving from the west-southwest. By 1:30 p. m. these had given place to St. from the south-southwest. Snow fell after 1:43 p. m. The head kite was at the base of the St.-Cu. at 8:01 a. m. in ascending; in descending it emerged from the Nb. at 1:48 p. m. The last 1,500 ft. (457 m.) of wire was coated with ice.

High pressure, central over eastern New York, overlay the Eastern and Northern States. An energetic low was centered over Colorada.

March 6, 1908.—Two kites were used; lifting surface, 126 sq. ft. (11.7 sq. m.). Wire out, 10,000 ft. (3,048 m.); at maximum altitude, 9,500 ft. (2,896 m.).

Dense fog prevailed thruout the flight.

An active disturbance was central over Wisconsin at 8 a. m., and rain or snow was falling eastward to the Atlantic. Pressure was high over New England, less high over Florida.

March 7, 1908.—Three kites were used; lifting surface, 145 sq. ft. (13.5 sq. m.). Wire out, 15,000 ft. (4,572 m.) at the maximum altitude.

Ci.-St. and Ci.-Cu. moving from the west were observed in amounts diminishing from 8/10 at the beginning to 2/10 at the end of the flight.

Low pressure occupied the St. Lawrence valley at 8 a. m., while centers of high pressure lay over Florida, western Tennessee, and Kansas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. March 9:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
12:19 p. m.	33.0	0.6	100	nw.	17	7.6	1,725	526	33.0	0.6	100	nw.	17	7.6
12:56 p. m.	32.8	0.4	100	nw.	17	7.6	2,965	904	27.0	— 2.8	....	nnw.	......	......
1:04 p. m.	33.0	0.6	100	nw.	21	9.4	3,917	1,194	24.8	— 4.8	....	nnw.	......	......
1:20 p. m.	33.2	0.7	95	nw.	23	10.3	5,233	1,595	27.9	— 2.3	....	nnw.	......	......
1:36 p. m.	32.8	0.4	86	nw.	25	11.2	6,549	1,996	31.1	— 0.5	....	nnw.	......	......
1:48 p. m.	32.5	0.3	83	nw.	26	11.6	8,391	2,558	19.6	— 6.9	....	nw.	......	......
2:06 p. m.	32.7	0.4	85	nw.	26	11.6	10,322	3,146	13.5	—10.3	....	nw.	......	......
2:30 p. m.	32.4	0.2	79	nw.	29	13.0	12,682	3,866	9.7	—12.4	....	wnw.	......	......
3:17 p. m.	33.0	0.6	74	nw.	33	14.8	11,209	3,417	12.6	—10.8	....	wnw.	......	......
3:40 p. m.	33.0	0.6	71	nw.	26	11.6	8,508	2,593	22.5	— 5.3	....	nw.	......	......
3:51 p. m.	33.1	0.6	67	nw.	25	11.2	6,648	2,026	26.4	— 3.1	....	nw.	......	......
4:03 p. m.	33.5	0.8	64	nw.	26	11.6	5,134	1,565	31.6	— 0.2	....	nw.	......	......
4:18 p. m.	33.8	1.0	65	nw.	26	11.6	4,250	1,295	32.4	0.2	....	nnw.	......	......
4:28 p. m.	34.2	1.2	65	nw.	23	10.3	3,567	1,087	24.8	— 4.0	....	nnw.	......	......
4:38 p. m.	34.0	1.1	63	nw.	24	10.7	2,838	865	27.3	— 2.6	...	nw.	......	......
4:42 p. m.	33.9	1.1	59	nw.	24	10.7	1,725	526	33.9	1.1	59	nw.	24	10.7
March 10:														
7:25 a. m.	28.0	— 2.2	71	nw.	24	10.7	1,725	526	28.0	— 2.2	71	nw.	24	10.7
7:29 a. m.	28.0	— 2.2	71	nw.	20	8.9	2,848	868	23.5	— 4.7	....	wnw.	......	......
7:47 a. m.	28.5	— 1.9	69	nw.	20	8.9	3,942	1,202	18.7	— 7.4	....	wnw.	......	......
7:56 a. m.	29.0	— 1.7	67	nw.	16	7.2	4,777	1,456	26.1	— 3.3	....	nw.	......	......
8:09 a. m.	29.2	— 1.6	66	nw.	16	7.2	5,174	2,103	21.0	— 6.1	....	nw.	......	......
8:19 a. m.	29.4	— 1.4	65	nw.	16	7.2	7,421	2,262	22.6	— 5.2	....	nw.	......	......
8:34 a. m.	29.5	— 1.4	64	nw.	17	7.6	8,791	2,679	18.9	— 7.3	....	nw.	......	......
9:01 a. m.	30.7	— 0.7	63	nw.	18	8.0	11,350	2,934	15.6	— 9.1	....	nw.	......	......
9:44 a. m.	31.3	— 0.4	66	nw.	18	8.0	10,901	2,718	17.8	— 7.9	....	wnw.	......	......
10:10 a. m.	31.0	— 0.6	66	nw.	19	8.5	6,701	2,042	22.3	— 5.4	....	wnw.	......	......
10:36 a. m.	32.0	0.0	67	nw.	15	6.7	5,266	1,605	24.8	— 4.0	....	wnw.	......	......
10:49 a. m.	33.5	0.8	67	nw.	14	6.3	3,448	1,051	23.2	— 4.9	....	wnw.	......	......
11:00 a. m.	33.8	1.0	62	nw.	15	6.7	1,725	526	33.8	1.0	62	nw.	15	6.7

March 9, 1908.—Four kites were used; lifting surface, 272 sq. ft. (25.2 sq. m.). Wire out, 22,000 ft. (6,706 m.); at maximum altitude, 20,000 ft. (6,096 m.).

Fog, generally dense, prevailed for more than twelve hours preceding the flight, became light at 12:49 p. m., and had disappeared at 1:08 p. m. The sky at this time was covered with low St. moving from the northwest. The leading kite entered these clouds at an altitude of 2,965 ft. (904 m.). Toward the end of the flight the St. disappeared and the sky was covered with 5/10 Ci.-St. from the west and 5/10 A.-Cu. from the west-northwest.

Pressure was low over the Gulf of St. Lawrence, with a secondary low over North Carolina, and was high over Kansas and over Florida.

March 10, 1908.—Four kites were used; lifting surface, 241 sq. ft. (22.4 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude the same.

One or two-tenths of St.-Cu. clouds, moving from the west-northwest, were visible during the flight.

High pressure covered the United States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. March 11:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:00 p. m.	55.0	12.8	25	w.	13	5.8	1,725	526	55.0	12.8	25	w.	13	5.8
1:14 p. m.	55.0	12.8	25	sw.	15	6.7	2,818	859	48.2	9.0	....	wsw.	......	......
2:07 p. m.	56.4	13.6	28	sw.	15	6.7	4,078	1,243	40.8	4.9	....	wsw.	......	......
2:43 p. m.	56.5	13.6	31	sw.	8	3.6	5,103	1,555	36.1	2.3	....	wsw.	......	......
3:05 p. m.	57.5	14.2	33	sw.	11	4.9	6,748	2,057	30.0	− 1.1	....	wnw.	......	......
3:17 p. m.	58.0	14.4	33	sw.	10	4.5	7,371	2,247	32.4	0.2	....	nw.	......	......
3:20 p. m.	58.1	14.5	33	sw.	10	4.5	7,631	2,326	32.0	0.0	....	nw.	......	......
4:02 p. m.	59.5	15.3	30	s.	13	5.8	5,258	1,603	37.0	2.8	....	w.	......	......
4:18 p. m.	56.2	13.4	31	sw.	15	6.7	4,200	1,280	42.6	5.9	....	wsw.	......	......
4:27 p. m.	54.0	12.2	33	s.	14	6.3	2,888	880	46.4	8.0	....	ssw.	......	......
4:32 p. m.	54.0	12.2	34	sw.	14	6.3	1,725	526	54.0	12.2	34	sw.	14	6.3
March 12:														
7:05 a. m.	41.0	5.0	80	nw.	22	9.8	1,725	526	41.0	5.0	80	nw.	22	9.8
7:10 a. m.	40.8	4.9	77	nw.	24	10.7	2,765	843	40.5	4.7	....	nw.	......	......
7:29 a. m.	42.0	5.6	70	nw.	22	9.8	4,316	1,316	38.8	3.8	....	nw.	......	......
7:40 a. m.	42.0	5.6	70	nw.	24	10.7	5,442	1,659	37.0	2.8	....	nw.	......	......
7:50 a. m.	42.8	6.0	67	nw.	25	11.2	5,707	1,740	40.3	4.6	....	nw.	......	......
8:20 a. m.	43.8	6.6	64	n.	20	8.9	7,660	2,335	35.2	1.8	....	nw.	......	......
8:40 a. m.	44.0	6.7	64	nw.	26	11.6	9,371	2,856	29.8	− 1.2	....	nw.	......	......
9:35 a. m.	46.5	8.1	60	n.	35	15.6	12,372	3,771	17.1	− 8.3	....	nw.	......	......
10:00 a. m.	46.7	8.2	57	nw.	24	10.7	14,038	4,279	12.0	−11.1	....	nw.	......	......
10:47 a. m.	48.7	9.3	49	nw.	22	9.8	16,170	4,928	3.2	−16.0	....	nw.	......	......
11:16 a. m.	51.0	10.6	44	nw.	21	9.4	13,212	4,027	15.3	− 9.3	....	nw.	......	......
11:40 a. m.	51.7	10.9	43	n.	20	8.9	10,427	3,178	25.9	− 3.4	....	nw.	......	......
12:02 p. m.	51.8	11.0	42	nw.	24	10.7	8,359	2,548	32.4	0.2	....	nw.	......	......
12:19 p. m.	53.2	11.8	40	nw.	22	9.8	5,863	1,787	39.6	4.2	....	nw.	......	......
12:24 p. m.	53.5	11.9	40	w.	22	9.8	4,875	1,486	42.3	5.7	....	nw.	......	......
12:27 p. m.	53.8	12.1	39	w.	19	8.5	4,059	1,237	39.2	4.0	....	nw.	......	......
12:40 p. m.	54.0	12.2	39	nw.	18	8.0	3,011	918	47.5	8.6	....	wnw.	......	......
12:46 p. m.	53.6	12.0	38	nw.	19	8.5	1,725	526	53.6	12.0	38	nw.	19	8.5

March 11, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 12,000 ft. (3,658 m.); at maximum altitude the same.

During the flight the sky was partly covered with Ci., Ci.-St. or Ci.-Cu. moving from the west.

High pressure was central over North Carolina at 8 a. m., and pressure was relatively low over the lower Mississippi Valley and north of the Lakes.

March 12, 1908.—Six kites were used; lifting surface, 398 sq. ft. (36.9 sq. m.). Wire out, 27,000 ft. (8,382 m.); at maximum altitude, 23,400 ft. (7,132 m.).

The sky was cloudless, except for a few A.-Cu. moving from the northwest before 8 a. m.

Pressure was high over the lower Mississippi Valley and low over Manitoba and Nova Scotia.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.					Miles	Met's							Miles	Met's
March 13:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
9:33 a. m.	48.5	9.2	53	s.	16	7.2	1,725	526	48.5	9.2	53	s.	16	7.2
9:44 a. m.	50.0	10.0	54	s.	14	6.3	2,813	857	45.9	7.7	....	sw.	......	......
9:55 a. m.	50.0	10.0	54	s.	14	6.3	3,919	1,194	43.7	6.5	....	sw.	......	......
10:06 a. m.	51.3	10.7	53	s.	13	5.8	5,065	1,544	40.6	4.8	....	sw.	......	......
10:19 a. m.	51.8	11.0	53	s.	16	7.2	6,219	1,896	40.6	4.8	....	sw.	......	......
10:26 a. m.	51.0	10.6	51	s.	15	6.7	7,494	2,284	35.2	1.8	....	sw.	......	......
10:48 a. m.	53.9	12.2	53	se.	15	6.7	8,214	2,504	32.4	0.2	..	sw.	......	......
11:10 a. m.	55.0	12.8	54	s.	19	8.5	10,247	3,123	23.0	− 5.0	....	sw.	......	......
11:45 a. m.	57.0	13.9	54	s.	17	7.6	12,046	3,672	19.4	− 7.0	....	sw.	......	......
12:23 p. m.	58.8	14.9	47	s.	23	10.3	10,954	3,339	23.4	− 4.8	....	sw.	......	......
12:33 p. m.	58.8	14.9	47	s.	22	9.8	9,867	3,008	27.1	− 2.7	....	sw.	.....	......
12:50 p. m.	59.0	15.0	46	s.	21	9.4	7,834	2,388	35.2	1.8	....	sw.	......	......
1:32 p. m.	60.0	15.6	46	sw.	20	8.9	5,138	1,566	39.2	4.0	....	ssw.	......	......
1:45 p. m.	60.0	15.6	46	s.	21	9.4	4,168	1,270	44.1	6.7	....	ssw.	......	......
1:51 p. m.	60.0	15.6	47	s.	21	9.4	2,975	907	49.6	9.8	....	ssw.	......	.....
2:03 p. m.	60.2	15.7	44	sw.	21	9.4	1,725	526	60.2	15.7	44	sw.	21	9.4
March 14:														
7:14 a. m.	40.9	4.9	77	nw.	27	12.1	1,725	526	40.9	4.9	77	nw.	27	12.1
7:21 a. m.	40.8	4.9	78	nw.	30	13.4	2,688	819	38.5	3.6	....	nw.	......	......
7:25 a. m.	41.0	5.0	77	nw.	30	13.4	3,107	947	36.7	2.6	....	nw.	......	......
7:41 a. m.	41.4	5.2	75	nw.	33	14.8	3,901	1,189	44.1	6.7	....	nw.	......	......
7:53 a. m.	41.4	5.2	76	nw.	31	13.9	4,852	1,479	41.0	5.0	....	nw.	......	......
8:02 a. m.	41.9	5.5	73	nw.	28	12.5	5,847	1,782	41.0	5.0	....	nw.	.....	......
10:09 a. m.	46.7	8.2	57	nw.	31	13.9	7,476	2,279	30.0	− 1.3	....	nw.	......	......
11:27 a. m.	50.0	10.0	44	nw.	17	7.2	6,673	2,034	35.6	2.0	....	wnw.	......	......
12:08 p. m.	53.0	11.7	42	w.	10	4.5	5,598	1,706	38.1	3.4	....	w.	......	......
12:12 p. m.	53.6	12.0	42	nw.	10	4.5	4,539	1,384	38.8	3.8	....	w.	......	.....
12:18 p. m.	53.7	12.1	40	w.	10	4.5	3,192	973	45.7	7.6	....	w.	......	......
12:22 p. m.	53.4	11.9	41	w.	11	4.9	1,725	526	53.4	11.9	41	w.	11	4.9
March 16:														
7:23 a. m.	42.4	5.8	72	nw.	15	6.7	1,725	526	42.4	5.8	72	nw.	15	6.7
7:32 a. m.	42.3	5.7	73	nw.	15	6.7	2,873	876	38.1	3.4	....	nw.	......	......
7:37 a. m.	42.3	5.7	73	nw.	15	6.7	3,207	978	38.1	3.4	....	wnw.	......	......
7:45 a. m.	42.3	5.7	73	nw.	15	6.7	3,961	1,207	35.2	1.8	....	wnw.	......	......
8:08 a. m.	42.8	6.0	72	nw.	15	6.7	5,958	1.816	28.0	− 2.2	....	wnw.	......	......
8:50 a. m.	44.8	7.1	70	nw.	15	6.7	7,660	2,335	20.5	− 6.4	....	w.	......	......
9:16 a. m.	45.0	7.2	67	nw.	20	8.9	6,809	2,076	23.9	− 4.5	....	wnw.	......	......
9:42 a. m.	46.5	8.1	62	nw.	23	10.3	5,734	1,748	27.5	− 2.5	....	wnw.	......	......
9:50 a. m.	47.5	8.6	62	nw.	23	10.3	5,268	1,606	28.8	− 1.8	....	wnw.	.....	......
10:02 a. m.	47.0	8.3	60	nw.	25	11.2	3,984	1,214	33.1	0.6	....	wnw.	......	......
10:17 a. m.	48.3	9.1	57	nw.	24	10.7	3,021	921	39.0	3.9	...	wnw.	......	......
10:21 a. m.	48.5	9.2	56	nw.	24	10.7	1,725	526	48.5	9.2	56	nw.	24	10.7

March 13, 1908.—Five kites were used; lifting surface, 340 sq. ft. (31.5 sq. m.). Wire out, 23,000 ft. (7.010 m.); at maximum altitude, 22,500 ft. (6,858 m.).

From a few to 1/10 Ci. were visible near the horizon during the flight. Occasional St.-Cu. from the south-southwest past below the upper kites.

A high was central over Nova Scotia and a low over Lake Huron.

March 14, 1908.—Six kites were used; lifting surface, 346 sq. ft. (32.1 sq. m.). Wire out, 19,700 ft. (6,005 m.); at maximum altitude, 15,000 ft. (4,572 m.).

From 1/10 to 3/10 A.-Cu. were visible until about 8 a. m., after which only a few St.-Cu. were to be seen until about 10 a. m. Thereafter Ci.-St. and Ci.-Cu. were present in amounts varying from 1/10 to 6/10. All clouds were moving from the northwest.

Low pressure areas were central over Wisconsin and over Nova Scotia. Pressure was high over the eastern Gulf States.

March 16.—Four kites were used; lifting surface, 272 sq. ft. (25.2 sq. m.). Wire out 15,000 ft. (4,572 m.); at maximum altitude the same.

The sky was overcast with St.-Cu. moving from the west-northwest early in the flight, but by the end the amount had decreased to 1/10.

Pressure was high over Lake Superior and low over the Gulf of St. Lawrence.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. March 17:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
9:09 a. m.	31.4	− 0.3	100	se.	17	7.6	1,725	526	31.4	− 0.3	100	se.	17	7.6
9:26 a. m.	31.0	− 0.6	100	se.	18	8.0	2,765	843	35.6	2.0	....	ssw.	......	......
10:04 a. m.	32.5	0.3	100	se.	22	9.8	4,076	1,242	42.8	6.0	....	ssw.	......	......
10:48 a. m.	34.0	1.1	90	se.	21	9.4	6,794	2,071	34.7	1.5	....	w.	......	......
11:40 a. m.	35.0	1.7	84	se.	21	9.4	8,344	2,543	30.0	− 1.1	....	w.	......	......
11:52 a. m.	36.0	2.2	86	se.	20	8.9	6,715	2,047	35.6	2.0	....	w.	......	......
12:35 p. m.	37.5	3.1	89	se.	18	8.0	3,352	1,022	46.4	8.0	....	sw.	......	......
12:59 p. m.	40.5	4.7	82	se.	18	8.0	2,335	712	36.5	2.5	....	ssw.	......	......
1:05 p. m.	41.5	5.3	79	se.	17	7.6	1,725	526	41.5	5.3	79	se.	17	7.6
March 18:														
1:00 p. m.	45.6	7.6	100	se.	19	8.5	1,725	526	45.6	7.6	100	se.	19	8.5
1:09 p. m.	46.5	8.1	96	se.	21	9.4	2,687	819	45.9	7.7	....	s.	......	......
1:20 p. m.	47.2	8.4	92	se.	21	9.4	3,950	1,204	57.6	14.2	....	sw.	......	......
1:33 p. m.	47.5	8.6	90	se.	20	8.9	5,338	1,627	54.9	12.7	....	wsw.	......	......
1:47 p. m.	47.3	8.5	92	se.	28	12.5	6,260	1,908	53.6	12.0	....	wsw.	......	......
2:00 p. m.	47.0	8.3	93	se.	23	10.3	7,300	2,225	51.3	10.7	....	w.	......	......
2:20 p. m.	47.3	8.5	91	se.	24	10.7	9,108	2,776	45.0	7.2	....	w.	......	......
2:35 p. m.	47.4	8.6	91	se.	24	10.7	10,152	3,095	42.3	5.7	....	w.	......	......
3:03 p. m.	48.0	8.9	90	se.	26	11.6	9,607	2,928	46.4	8.0	....	w.	......	......
3:15 p. m.	48.0	8.9	90	se.	24	10.7	4,005	1,221	58.6	14.8	....	sw.	......	......
4:00 p. m.	45.3	7.4	90	se.	22	9.8	1,725	526	45.3	7.4	90	se.	22	9.8
March 19:														
9:14 a. m.	53.3	11.8	91	nw.	16	7.2	1,725	526	53.3	11.8	91	nw.	16	7.2
9:24 a. m.	52.8	11.6	94	nw.	15	6.7	2,678	816	54.3	12.4	....	wnw.	......	......
9:37 a. m.	52.2	11.2	94	nw.	16	7.2	3,529	1,076	51.1	10.6	....	wnw.	......	......
9:53 a. m.	52.5	11.4	95	nw.	16	7.2	4,420	1,347	48.9	9.4	....	wnw.	......	......
11:18 a. m.	54.1	12.3	....	nw.	24	10.7	6,058	1,845	53.4	11.9	....	wnw.	......	......
11:38 a. m.	55.7	13.2	....	nw.	23	10.3	10,433	3,180	29.1	− 1.6	....	wnw.	......	......
1:42 p. m.	55.9	13.3	....	nw.	30	13.4	8,589	2,618	36.5	2.5	....	wnw.	......	......
3:12 p. m.	51.6	10.9	....	nw.	42	18.0	7,501	2,286	41.4	5.2	....	wnw.	......	......
3:46 p. m.	47.6	8.7	....	nw.	46	20.6	6,930	2,112	36.5	2.5	....	wnw.	......	......
3:58 p. m.	46.0	7.8	....	nw.	39	17.4	5,347	1,630	42.4	5.8	....	nw.	......	......
4:15 p. m.	45.0	7.2	....	nw.	38	17.0	4,221	1,287	48.6	9.2	....	nw.	......	......
6:21 p. m.	37.5	3.1	....	nw.	54	24.1	1,725	526	37.5	3.1	....	nw.	54	24.1

March 17, 1908.—Three kites were used; lifting surface, 194 sq. ft. (18.0 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude, 19,500 ft. (5,944 m.).

Dense fog prevailed until 10:07 a. m. During the remainder of the flight the sky was overcast with A.-St. and St. from the west, and with low St. from the south.

A ridge of high pressure extended from the St. Lawrence to New Jersey, and areas of low pressure were central over northern Michigan and Oklahoma.

March 18, 1908.—Five kites were used; lifting surface, 234 sq. ft. (21.7 sq. m.). Wire out, 22,800 ft. (6,949 m.); at maximum altitude, 17,500 ft. (5,334 m.).

Dense fog prevailed until 1:00 p. m. During the remainder of the flight the sky was overcast with St., except for an occasional break in the clouds when small patches of blue sky were visible.

Pressure was high over the lower St. Lawrence. An area of low pressure was central over Oklahoma.

March 19, 1908.—Five kites were used; lifting surface, 340 sq. ft. (31.5 sq. m.). Wire out, 14,950 ft. (4,557 m.); at maximum altitude the same.

Dense fog preceded the flight but had disappeared by 8 a. m., at which time the sky was overcast with St. moving from the west. The St. soon disappeared and were succeeded by Ci.-Cu. and A.-Cu. from the west and St.-Cu. from the west-northwest. From 11 a. m. to 4 p. m. the sky was generally clear, except for a long stationary cloud over the Loudoun Valley, the nearest edge about 5 miles (8 km.) southeast of the station and the elevation of the base about 3,500 ft. (1,067 m.). After 4 p. m. the sky was partly covered with A.-Cu. moving from the west and St.-Cu. moving from the northwest.

An area of low pressure was central off the southern New England coast, and areas of high pressure were over Florida and the Missouri Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. March 20:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:40 p. m.	26.5	— 3.1	47	nw.	15	6.7	1,725	526	26.5	— 3.1	47	nw.	15	6.7
1:57 p. m.	26.0	— 3.3	47	nw.	13	5.8	2,206	672	21.4	— 5.9	....	nnw.	......	......
2,15 p. m.	26.0	— 3.3	46	n.	12	5.4	3,417	1,042	17.6	— 8.0	....	nnw.	......	......
2:50 p. m.	25.5	— 3.6	46	n.	8	3.6	4,918	1,498	11.5	—11.4	....	nnw.	......	......
2:59 p. m.	26.0	— 3.3	52	n.	9	4.0	5,554	1,693	16.0	— 8.9	....	nnw.	......	......
3:15 p. m.	26.0	— 3.3	52	n.	9	4.0	7,193	2,192	11.3	—11.5	....	nw.	......	......
3:20 p. m.	26.0	— 3.3	52	nw.	9	4.0	4,950	1,523	12.0	—11.1	....	nnw.	......	......
3:27 p. m.	26.5	— 3.1	52	nw.	9	4.0	3,909	1,192	15.1	— 9.4	....	nnw.	......	......
3:35 p. m.	27.0	— 2.8	53	n.	9	4.0	2,618	798	21.4	— 5.9	....	nnw.	......	......
3:39 p. m.	26.8	— 2.9	53	nw.	10	4.5	1,725	526	26.8	— 2.9	53	nw.	10	4.5
March 21:														
7:20 a. m.	21.3	— 5.9	64	nw.	19	8.5	1,725	526	21.3	— 5.9	64	nw.	19	8.5
7:26 a. m.	21.9	— 5.6	60	nw.	20	8.9	2,874	876	19.0	— 7.2	....	nnw.	......	......
7:33 a. m.	22.0	— 5.6	60	nw.	20	8.9	3,506	1,069	17.1	— 8.3	....	nnw.	......	......
8:38 a. m.	24.7	— 4.1	54	nw.	24	10.7	4,293	1,308	22.1	— 5.5	....	nnw.	......	......
10:00 a. m.	28.8	— 1.8	51	nw.	24	10.7	5,967	1,819	16.7	— 8.5	....	nnw.	......	......
10:19 a. m.	29.9	— 1.2	47	nw.	23	10.3	8,684	2,647	7.0	—13.9	....	nw.	......	......
10:35 a. m.	30.0	— 1.1	57	nw.	18	8.0	6,687	2,038	14.7	— 9.6	....	nw.	......	......
10:48 a. m.	30.9	— 0.6	44	nw.	21	9.4	4,580	1,396	23.5	— 4.7	....	nnw.	......	......
10:58 a. m.	31.5	— 0.3	44	nw.	20	8.9	3,523	1,074	20.1	— 6.6	....	nnw.	......	......
11:08 a. m.	32.0	0.0	48	nw.	20	8.9	2,861	872	23.5	— 4.7	....	n.	......	......
11:18 a. m.	32.0	0.0	45	nw.	18	8.0	1,725	526	32.0	0.0	45	nw.	18	8.0
March 23:														
11:07 a. m.	43.8	6.6	100	s.	10	4.5	1,725	526	43.8	6.6	100	s.	10	4.5
11:15 a. m.	44.0	6.7	100	s.	10	4.5	2,781	848	46.8	8.2	....	s.	......	......
11:24 a. m.	44.0	6.7	100	se.	10	4.5	4,173	1,272	44.2	6.8	....	ssw.	......	......
11:38 a. m.	44.5	6.9	100	s.	10	4.5	5,222	1,592	41.7	5.4	....	ssw.	......	......
11:54 a. m.	44.8	7.1	100	s.	9	4.0	6,463	1,970	38.3	3.5	....	ssw.	......	......
12:22 p. m.	46.2	7.9	100	s.	10	4.5	7,656	2,334	34.7	1.5	....	sw.	......	......
12:35 p. m.	47.0	8.3	100	sw.	9	4.0	9,199	2,804	32.0	0.0	....	sw.	......	......
1:10 p. m.	48.6	9.2	100	sw.	10	4.5	10,558	3,218	29.3	— 1.5	....	sw.	......	......
1:25 p. m.	49.2	9.6	100	sw.	8	3.6	9,285	2,830	32.4	0.2	....	sw.	......	......
1:42 p. m.	50.0	10.0	98	sw.	7	3.1	8,536	2,602	32.9	0.5	....	sw.	......	......
2:00 p. m.	49.5	9.7	98	s.	4	1.8	6,162	1,878	41.0	5.0	....	sw.	......	......
2:25 p. m.	52.3	11.3	94	sw.	8	3.6	4,225	1,288	46.4	8.0	....	wsw.	......	......
2:32 p. m.	53.0	11.7	94	sw.	7	3.1	3,018	920	48.2	9.0	....	sw.	......	......
2:42 p. m.	51.3	10.7	97	se.	5	2.2	1,725	526	51.3	10.7	97	se.	5	2.2

March 20, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 8,500 ft. (2,591 m.); at maximum altitude, 7,000 ft. (2,134 m.).

The sky was covered with St. from the northwest. Snow fell from 2:33 to 2:50 p. m.

At 8 a. m. lows were central over Lake Superior and Georgia. A high was over the Gulf of St. Lawrence.

March 21, 1908.—Five kites were used; lifting surface, 341 sq. ft. (31.6 sq. m.). Wire out, 18,500 ft. (5,639 m.); at maximum altitude, 11,000 ft. (3,353 m.).

The sky was cloudless until 10:30 a. m., and only a few St.-Cu., moving from the northwest, were present thereafter.

High pressure was central over eastern Kentucky and western Virginia; low pressure over northern Minnesota.

March 23, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude, 17,000 feet (5,182 m.).

Dense fog and light mist prevailed until 1:10 p. m., at which time the mist ended and the fog became light. Light fog continued until the end of the flight.

A trough of low pressure extended from Lake Superior to the mouth of the Mississippi, accompanied by rain from the Ohio Valley southward. Pressure was high off the Florida coast.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.					Miles	Met's							Miles	Met's
March 24:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
7:21 a.m.	44.6	7.0	67	nw.	17	7.6	1,725	526	44.6	7.0	67	nw.	17	7.6
7:30 a.m.	44.7	7.1	66	nw.	15	6.7	2,923	891	44.7	7.1	....	wnw.	.....	.....
7:39 a.m.	44.7	7.1	66	nw.	12	5.4	3,908	1,191	36.5	2.5	....	wnw.	.....	.....
7:50 a.m.	45.7	7.6	63	nw.	10	4.5	4,955	1,510	31.1	— 0.5	....	w.	.....	.....
8:08 a.m.	45.8	7.7	62	nw.	28	12.5	6,855	2,090	26.6	— 3.0	...	w.	....	.....
8:19 a.m.	48.0	8.9	50	nw.	29	13.0	6,028	1,837	30.2	— 1.0	....	w.	.....	.....
8:54 a.m.	48.0	8.9	59	nw.	24	10.7	4,794	1,461	32.0	0.0	....	wnw.	.....	.....
9:12 a.m.	48.2	9.0	59	nw.	20	8.9	3,754	1,144	36.5	2.5	....	wnw.	.....	.....
9:21 a.m.	48.2	9.0	59	nw.	22	9.8	2,855	870	41.0	5.0	....	wnw.	.....	.....
9:25 a.m.	48.2	9.0	59	nw.	20	8.9	1,725	526	48.2	9.0	59	nw.	20	8.9
March 25:														
2:41 p.m.	45.2	7.3	52	se.	10	4.5	1,725	526	45.2	7.3	52	se.	10	4.5
3:14 p.m.	44.0	6.7	54	se.	11	4.9	2,424	739	40.1	4.5	....	se.	.....	.....
4:03 p.m.	43.8	6.6	55	se.	12	5.4	3,360	1,024	38.3	3.5	....	sw.	.....	.....
4:25 p.m.	44.0	6.7	57	se.	13	5.8	5,064	1,544	31.3	— 0.4	....	sw.	.....	.....
5:00 p.m.	43.3	6.3	61	se.	16	7.2	8,228	2,508	24.3	— 4.3	....	w.	.....	.....
5:08 p.m.	43.1	6.2	62	se.	16	7.2	11,553	3,522	17.6	— 8.0	....	w.	.....	.....
5:37 p.m.	43.3	6.3	62	se.	15	6.7	9,206	2,706	21.2	— 6.0	....	w.	.....	.....
6:00 p.m.	43.0	6.3	62	se.	14	6.3	7,876	2,400	24.8	— 4.0	....	w.	.....	.....
6:15 p.m.	43.8	6.1	63	se.	14	6.3	6,444	1,964	29.6	— 1.3	....	w.	.....	.....
6:32 p.m.	42.5	5.8	66	se.	14	6.3	3,443	1,049	36.7	2.6	....	sw.	.....	.....
6:42 p.m.	42.5	5.8	66	se.	15	6.7	2,766	843	39.2	4.0	....	s.	.....	.....
6:46 p.m.	42.5	5.8	66	se.	15	6.7	1,725	526	42.5	5.8	66	se.	15	6.7
March 26:														
7:11 a.m.	39.5	4.2	88	s.	18	8.0	1,725	526	39.5	4.2	88	s.	18	8.0
7:15 a.m.	40.0	4.4	86	s.	17	7.6	2,890	881	52.5	11.4	....	wsw.	.....	.....
7:30 a.m.	40.2	4.6	86	s.	16	7.2	3,966	1,209	56.8	13.8	...	wsw.	.....	.....
7:47 a.m.	41.0	5.0	88	s.	16	7.2	5,538	1,688	49.6	9.8	....	wsw.	.....	.....
8:02 a.m.	42.0	5.6	88	s.	16	7.2	6,770	2,063	45.0	7.2	....	wsw.	.....	.....
8:48 a.m.	44.6	7.0	75	s.	16	7.2	5,294	1,614	52.5	11.4	....	wsw.	.....	.....
10:20 a.m.	52.0	11.1	69	s.	16	7.2	3,793	1,156	57.6	14.2	....	wsw.	.....	.....
1:41 p.m.	67.9	19.9	36	sw.	24	10.7	2,965	904	59.7	15.4	....	ssw.	.....	.....
2:08 p.m.	67.1	19.5	36	sw.	28	12.5	1,725	526	67.1	19.5	36	sw.	28	12.5

March 24, 1908.—Two kites were used; lifting surface, 142 sq. ft. (13.1 sq. m.). Wire out, 10,650 ft. (3,246 m.); at maximum altitude the same.

6/10 Ci. were visible moving from the west and 2/10 St. from the west-northwest.

A low was central over the Gulf of St. Lawrence and a secondary low over Georgia.

March 25, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude the same.

At the beginning the sky was overcast with A.-St. moving from the west. Light rain began at 3:05 and ended at 3:58 p. m. The clouds decreased from 10 St.-Cu. at 3:58 to few St.-Cu. at 6:48 p. m.

An area of high pressure, central over eastern Canada, occupied the region east of the Mississippi. An extensive low was central over Wyoming.

March 26, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 15,000 ft. (4,572 m.); at maximum altitude, 11,000 ft. (3,353 m.).

Ci. moving from the west-northwest were present in amounts varying between 1/10 and 8/10.

Pressure was low over the Lake region and high off the middle Atlantic coast.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.						
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. March 27:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:04 p. m.	73.0	22.8	73	se.	12	5.4	1,725	526	73.0	22.8	73	se.	12	5.4
1:12 p. m.	74.3	23.5	73	se.	14	6.3	2,836	864	64.4	18.0	....	s.	......	......
1:28 p. m.	73.2	22.9	73	se.	15	6.7	3,889	1,171	57.2	14.0	....	s.	......	......
2:00 p. m.	74.5	23.6	78	s.	16	7.2	6,262	1,909	50.7	10.4	....	ssw.	......	......
2:37 p. m.	75.0	23.9	72	se.	16	7.2	8,293	2,544	41.9	5.5	....	sw.	......	......
2:46 p. m.	75.0	23.9	72	se.	16	7.2	8,637	2,633	43.3	6.3	....	sw.	......	......
3:07 p. m.	75.0	23.9	71	se.	15	6.7	11,581	3,520	31.1	− 0.5	....	w.	......	......
3:20 p. m.	75.0	23.9	71	s.	15	6.7	13,944	4,250	21.2	− 6.0	....	w.	......	......
3:46 p. m.	74.5	23.6	68	se.	15	6.7	17,014	5,186	14.5	−10.0	....	w.	....	.....
4:32 p. m.	74.0	23.3	70	s.	16	7.2	12,927	3,940	27.5	− 2.5	....	w.	......	......
4:44 p. m.	73.0	22.8	73	s.	13	5.8	12,159	3,706	32.0	0.0	....	w.	......	......
5:11 p. m.	73.0	22.8	73	s.	13	5.8	9,194	2,276	46.4	8.0	....	w.	......	......
5:22 p. m	72.5	22.5	74	s.	13	5.8	6,774	2,065	45.1	7.3	....	wsw.	......	......
5:40 p. m.	71.0	21.7	77	s.	11	4.9	4,297	1,310	58.1	14.5	....	sw.	......	......
5:51 p. m.	70.3	21.3	79	s.	10	4.5	2,888	880	65.5	18.6	....	ssw.	......	......
5:57 p. m.	70.0	21.1	80	se.	10	4.5	1,725	526	70.0	21.1	80	se.	10	4.5
March 28:														
7:27 a. m	56.8	13.8	81	s.	8	3.6	1,725	526	56.8	13.8	81	s.	8	3.6
7:37 a. m.	56.0	13.3	81	s.	10	4.5	2,988	896	65.8	18.8	....	sw.	......	......
7:47 a. m.	56.0	13.3	82	sw.	12	5.4	4,022	1,226	61.9	16.6	....	wsw.	......	......
7:57 a m.	57.2	14.0	80	sw.	12	5.4	5,313	1,629	55.0	12.8	....	w.	......	......
8:11 a. m.	58.0	14.4	76	s.	12	5.4	6,421	1,957	63.4	11.9	....	w.	......	......
8:40 a. m.	59.3	15.2	72	sw.	12	5.4	8,001	2,439	46.0	7.8	....	w.	......	......
8:58 a. m.	59.4	15.2	78	sw.	8	3.6	6,687	2,038	49.8	9.6	....	wnw.	......	......
9:56 a. m	62.0	16.7	72	sw.	5	2.2	4,900	1,494	51.4	10.8	....	wnw.	......	......
10:20 a. m.	57.0	13.9	83	se.	9	4.0	3,724	1,135	57.0	13.9	....	w.	......	......
10:31 a. m.	57.0	13.9	84	s.	9	4.0	2,905	885	61.3	16.3	....	wsw.	......	......
10:35 a. m.	57.0	13.9	63	s.	11	4.9	1,725	526	57.0	13.9	83	s.	11	4.9
March 30:														
9:09 a. m.	36.2	2.3	55	nw.	20	9.0	1,725	526	36.2	2.3	55	nw.	20	9.0
9:16 a. m.	37.0	2.8	54	nw.	19	8.5	2,885	879	29.5	− 1.4	....	nw.	......	......
10:30 a. m.	38.2	3.4	49	nw.	14	6.3	3,002	915	28.4	− 2.0	....	nw.	......	......
10:42 a. m.	38.3	3.5	51	nw.	12	5.4	2,278	694	32.0	0.0	....	nw.	......	......
10:48 a. m.	39.2	4.0	46	nw.	11	4.9	1,725	526	39.2	4.0	46	nw.	11	4.9

March 27, 1908.—Five kites were used; lifting surface, 346 sq. ft. (32.0 sq. m.). Wire out, 25,000 ft. (7,620 m.); at maximum altitude, 24,500 ft. (7,468 m.).

Ci. moving from the west were visible at the beginning and end of flight. From 3:46 to 5:15 p. m. the sky was cloudless.

At 8 a. m. highs were central over the south Atlantic coast and the upper Lakes. A low was central over Colorado.

March 28, 1908.—Four kites were used; lifting surface, 272 sq. ft. (25.2 sq. m.). Wire out, 15,000 ft. (4,572 m.); at maximum altitude the same.

At the beginning two-thirds of the sky was covered with A.-St. moving from the west and one-third with St. from the west-southwest. The proportion of St. gradually increased to 8/10, moving from the west, at 8:30 a. m. Light rain fell from 8:50 to 10:25 a. m.

Low pressure was central over Lake Ontario and rain was falling southward to Virginia. High pressure lay over the South Atlantic States and over Nova Scotia.

March 30, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 4,900 ft. (1,494 m.); at maximum altitude, 3,000 ft. (914 m.).

From 7/10 to 10/10 Ci.-St. and A.-St. were present, moving from the west-northwest. A solar halo was observed at 9:25 a. m. and was visible during the remainder of the flight.

An extensive area of high pressure, central over West Virginia, overlay the eastern half of the country.

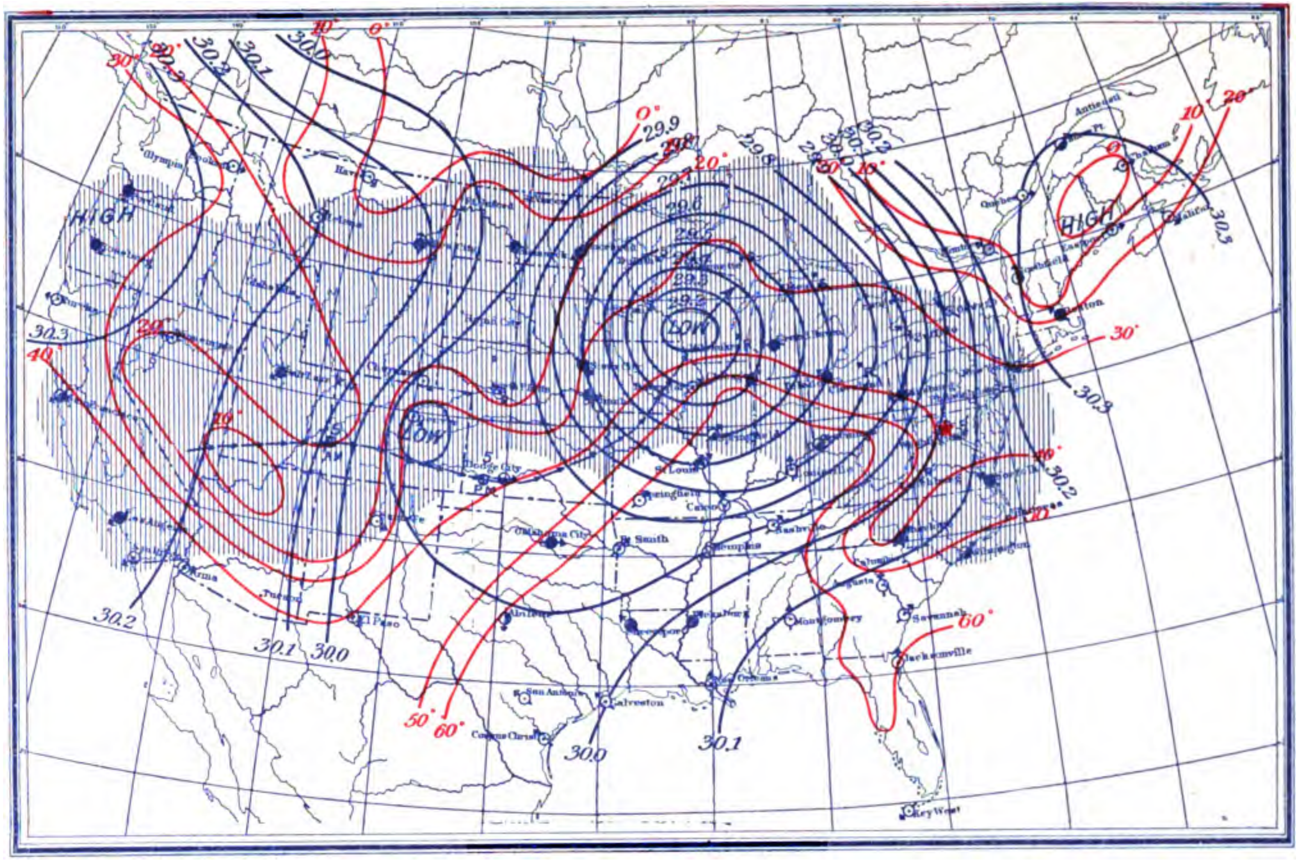
RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. March 31:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
10:23 a. m.	38.0	3.3	100	se.	13	5.8	1,725	526	38.0	3.3	100	se.	13	5.8
10:30 a. m.	38.4	3.6	100	se.	16	7.2	2,842	866	50.0	10.0	....	sw.	......	......
10:36 a. m.	38.7	3.7	100	se.	17	7.6	3,380	1,030	51.8	11.0	....	sw.	......	......
10:54 a. m.	39.0	3.9	100	s.	15	6.7	5,506	1,678	46.6	8.1	....	sw.	......	......
11:09 a. m.	39.6	4.2	100	s.	13	5.8	6,935	2,114	43.9	6.6	....	sw.	......	......
11:26 a. m.	40.0	4.4	100	s.	15	6.7	8,123	2,476	39.2	4.0	....	sw.	......	......
11:47 a. m.	40.0	4.4	100	s.	12	5.4	10,136	3,090	31.3	− 0.4	....	w.	......	......
12:13 p. m.	41.0	5.0	100	s.	12	5.4	11,606	3,538	25.7	− 3.5	....	w.	......	......
1:06 p. m.	41.0	5.0	100	s.	12	5.4	10,023	3,055	32.7	0.4	....	w.	......	......
1:31 p. m.	41.2	5.1	100	s.	10	4.5	9,523	2,903	34.7	1.5	....	w.	......	......
2:08 p. m.	42.0	5.6	100	s.	9	4.0	7,120	2,170	45.5	7.5	....	w.	......	......
2:16 p. m.	42.1	5.6	100	se.	8	3.6	6,061	1,848	42.1	5.6	....	w.	......	......
2:33 p. m.	43.4	6.3	100	se.	9	4.0	4,258	1,278	49.1	9.5	....	w.	......	......
2:43 p. m.	43.4	6.3	100	se.	9	4.0	3,195	974	52.7	11.5	....	wsw.	......	......
2:50 p. m.	43.0	6.1	100	se.	9	4.0	1,725	526	43.0	6.1	100	se.	9	4.0

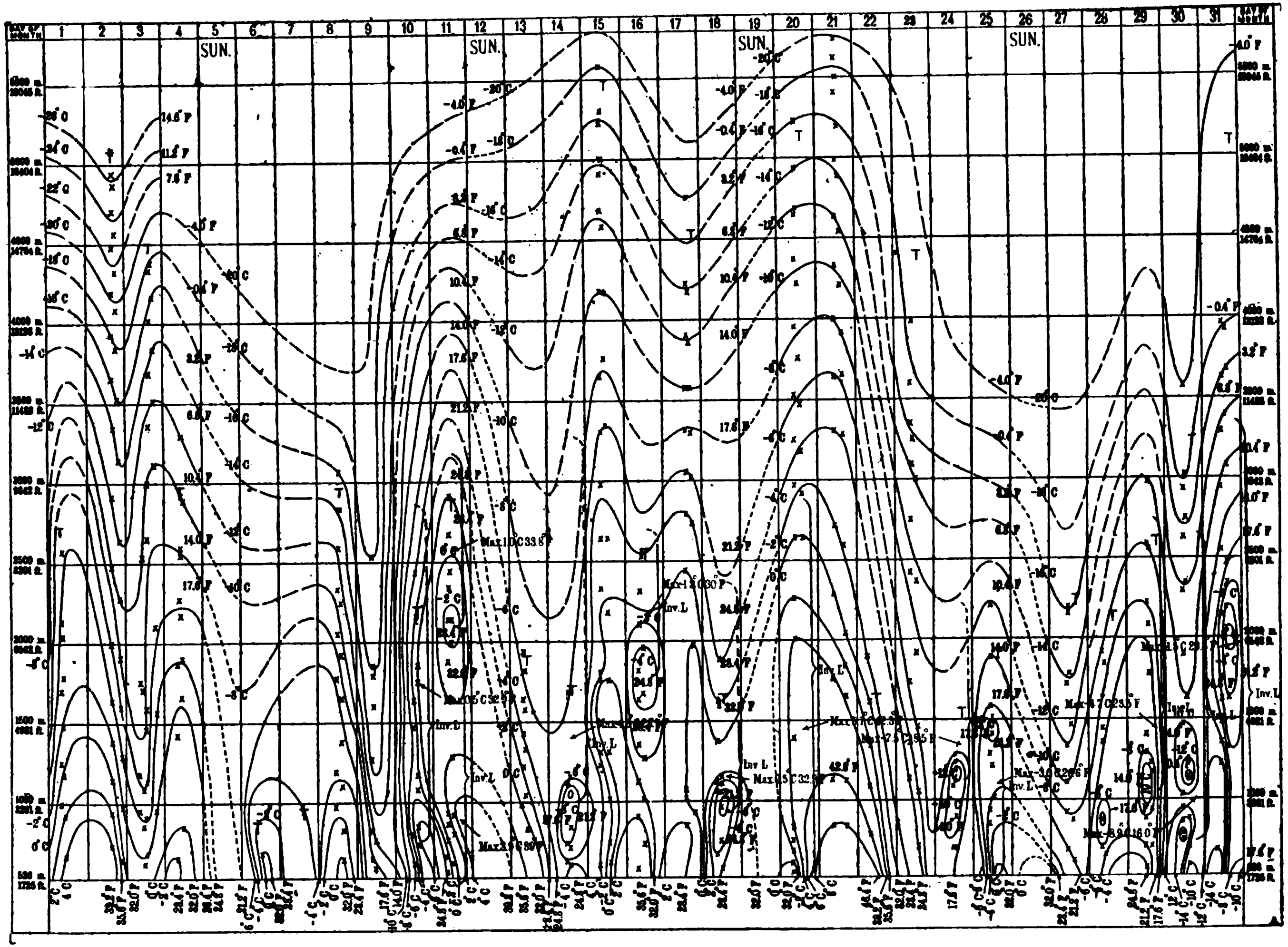
March 31, 1908.—Four kites were used; lifting surface, 272 sq. ft. (25.2 sq. m.). Wire out, 25,000 ft. (7,620 m.); at maximum altitude, 24,000 ft. (7,315 m.).

Dense fog prevailed during the entire flight.

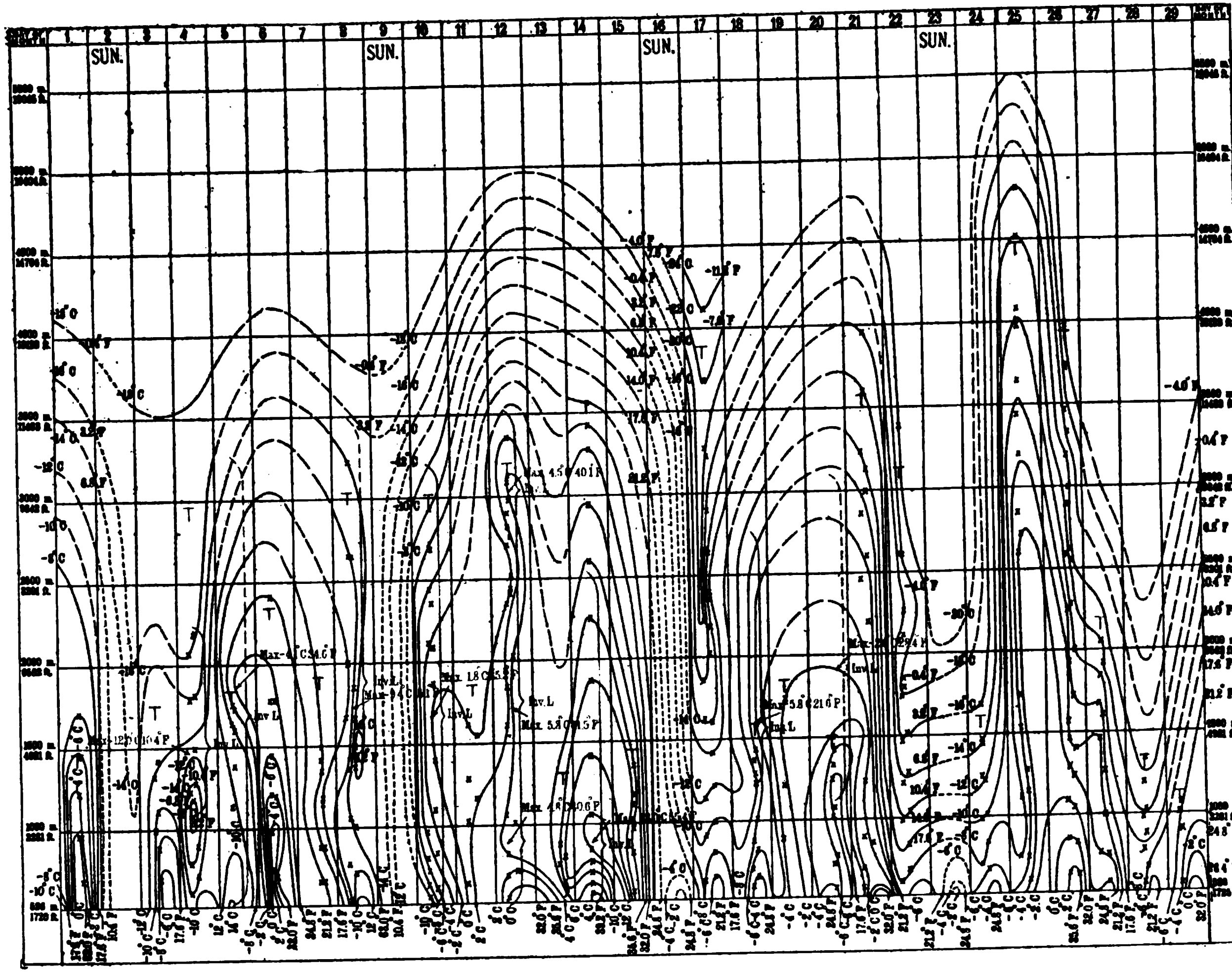
Low pressure was central over the upper Lakes and high pressure off the Atlantic coast.



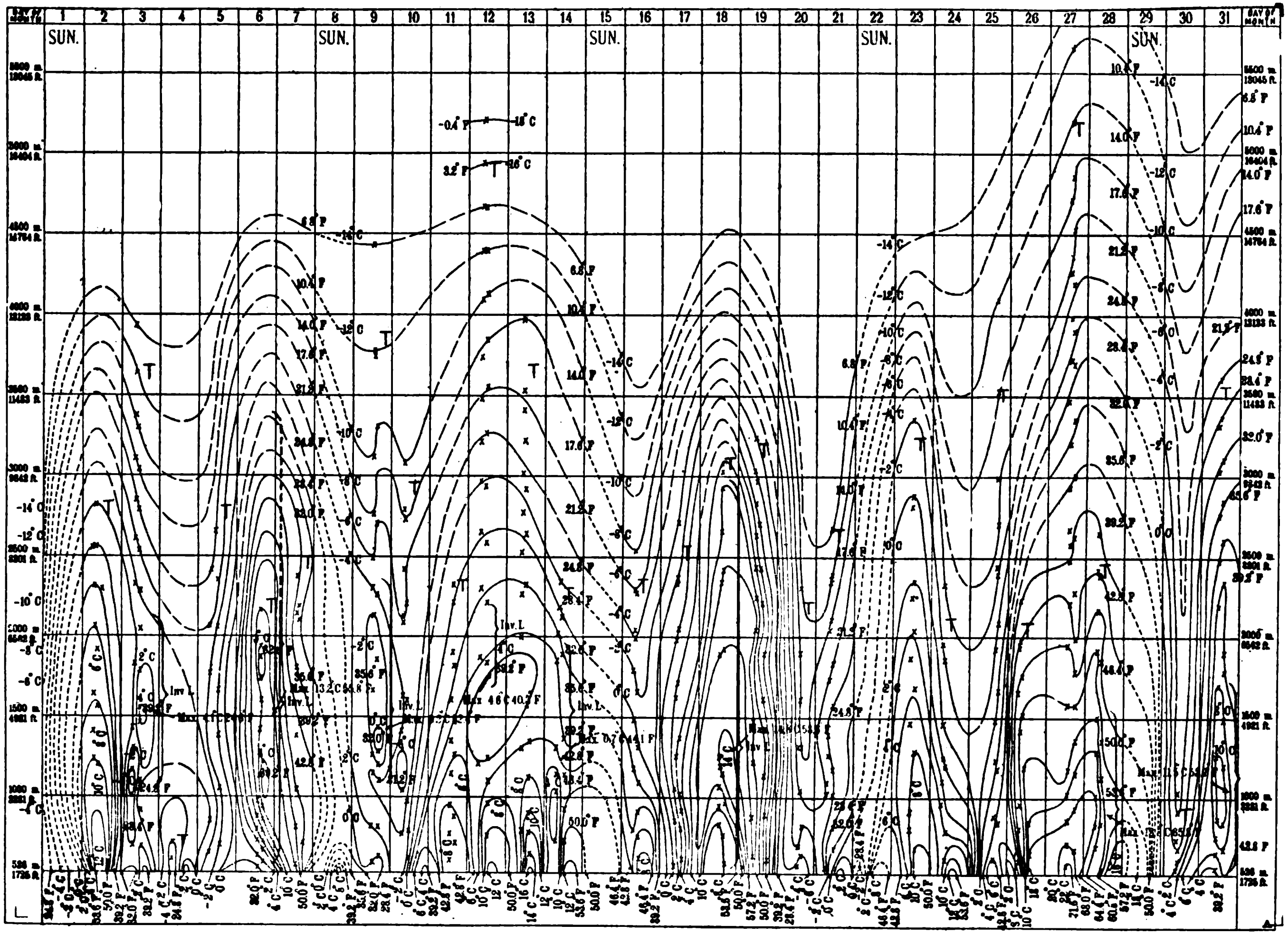
Daily weather map, March 6, 1908.



Upper air isotherms, January, 1908.



Upper air isotherms, February, 1908.



Upper air isotherms, March, 1908.

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U. S. DEPARTMENT OF AGRICULTURE

Vol. I. **BULLETIN** Part [illegible]

OF THE

MOUNT WEATHER OBSERVATORY

William J. Humphreys, Ph. D., Director
William R. Blair, Ph. D., Assistant Director

PREPARED UNDER THE DIRECTION OF

WILLIS L. MOORE, D. Sc., LL. D.

CHIEF U. S. WEATHER BUREAU

WASHINGTON
U. S. WEATHER BUREAU
190[illegible]

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Vol. I

BULLETIN

Part 4

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1908

CONTENTS.

PYRHELIOMETER AND POLARIMETER OBSERVATIONS.

By H. H. Kimball.

Reduction of Pyrheliometric Observations.

In a paper in Part 2 of this Bulletin are given the results of the intercomparison of pyrheliometers that have been employed at the Central Office of the Weather Bureau, Washington, D. C., and at the Research Observatory, Mount Weather, Va. Frequent reference will here be made to this paper under the title "Comparison of pyrheliometers." Since December, 1905, pyrheliometric observations have been confined to days when the sky was practically free from clouds, and on such days the object has been to obtain observations over as great a range of air mass as was practicable.

The latitude of Washington is 38° 54′ north. The altitude of the sun at noon at the time of the summer solstice is 74° 33′, and at the time of the winter solstice, 27° 39′. The corresponding air masses are 1.05 and 2.15, respectively, unit air mass being the length of path of the sun's rays thru the earth's atmosphere with the sun in the zenith. Air masses have been computed from Laplace's extinction formula

$$m = \frac{\text{refraction in seconds (from Bessel's tables)}}{58.36 \times \sin Z}$$

where $m =$ the air mass, and $Z =$ the zenith distance of the sun. Observations in Washington are made from the roof of the Weather Bureau Building, about 118 feet above sea level. Variations in barometric pressure have been disregarded.

In winter, observations are frequently continued until the sun is within 10° of the horizon, the corresponding air mass being about 6.0. In summer, observations are rarely taken with the sun at a greater hour angle from the meridian than $5^h\ 30^m$, the corresponding air mass being about 3.0.

The scale errors of the milammeters employed have been determined by the U. S. Bureau of Standards to the nearest 0.5 milliampere. These, and a temperature correction amounting to 0.25 per cent of the scale reading for a change in the temperature of the coils of 20° F., have been applied to all milammeter readings. It has been assumed that the temperature of the milammeter coils is the same as the temperature of the shelter in which the pyrheliometer with its auxiliary apparatus is exposed.

In Table 1 are given the pyrheliometer readings that correspond to certain air masses, reduced to the scale of Ångström pyrheliometer No. 104. Since it is not practicable to obtain readings at the exact moment corresponding to these air masses, the indications of each instrument[1] have been plotted on millimeter cross-section paper as shown in figs. 2 and 3, where abscissas represent air masses and ordinates represent the value of the second decimal figure in the logarithm of the pyrheliometer readings. The first decimal figure for the readings on any day may be determined from the value of the logarithm for zero atmosphere on that day.

The logarithms of the readings corresponding to any desired air mass have been read off from the smooth curve that appears to best fit the observations, and then corrected by the amount necessary to reduce the readings to the scale of Ångström pyrheliometer No. 104, the amount of the correction being obtained from the ratios given in Table 4, Comparison of pyrheliometers. Generally the curve representing the probable mean of the observations approximates very closely to a straight line.

TABLE 1.—*Washington pyrheliometer readings reduced to the scale of Ångström No. 104.*

Date.	Air mass.								
	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
1905.									
December 22, p. m					1.019	1.111	1.211		
December 26, p. m	0.794	0.827	0.902	0.960	1.014	1.104	1.200		
1906.									
January 9, p. m		0.770	0.852	0.943	1.069	1.155	1.279		
January 10, p. m	0.871	0.912	0.956	1.024	1.097	1.175	1.259		
January 29, p. m				0.930	1.002	1.106	1.228		
January 30, p. m				0.675	0.774	0.854	0.972		
February 13, p. m		0.862	0.921	0.992	1.062	1.154	1.237	1.330	
February 15, p. m			0.948	1.016	1.093	1.180	1.281	1.393	
March 22, p. m					0.919	1.032	1.108	1.214	
April 2, p. m					0.979	1.075	1.180	1.295	
April 17, a. m						0.850	0.971	1.110	1.268
April 17, p. m						0.865	0.956	1.097	1.257
April 18, a. m							0.960	1.117	1.299
May 18, p. m						0.647	0.775	0.930	1.114
May 29, a. m						0.977	1.096	1.230	1.380
May 29, p. m						1.057	1.130	1.244	1.374
September 25, p. m							1.036	1.119	
October 8, p. m					0.838	0.954	1.086	1.235	
October 12, p. m	0.769	0.822	0.878	0.937	1.000	1.068	1.141	1.218	
October 15, p. m			0.735	0.804	0.879	0.970	1.074	1.188	
November 1, p. m	0.801	0.863	0.981	1.005	1.083	1.176	1.284	1.413	
November 2, a. m					1.101	1.181	1.266	1.357	
November 2, p. m	0.786	0.848	0.916	0.989	1.068	1.153	1.245	1.343	
November 3, a. m					1.130	1.208	1.290	1.378	
November 3, p. m	0.843	0.904	0.970	1.040	1.107	1.195	1.292	1.396	
November 6, a. m					1.008	1.110	1.227	1.372	
November 6, p. m	0.747	0.815	0.891	0.972	1.061	1.159	1.265	1.393	
November 7, a. m					1.151	1.224	1.300	1.381	
November 7, p. m	0.748	0.810	0.883	0.962	1.050	1.143	1.246	1.358	
November 22, p. m	0.914	0.964	1.017	1.073	1.139	1.215	1.296		
November 24, p. m			0.641	0.717	0.801	0.894			
November 27, p. m	0.632	0.704	0.783				1.201		

[1] See p. 84, Part 2, Vol. I of this Bulletin for a description of the method by which instrumental observations have been reduced.

TABLE 1.—*Washington pyrheliometer readings, etc.*—Continued.

Date.	Air mass.								
	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
1907.									
January 21, p. m	0.844	0.901	0.960	1.026	1.102	1.186	1.276		
January 23, p. m		0.914	0.978	1.048	1.123	1.202	1.311		
January 28, a. m					0.780	0.880	0.992		
January 28, p. m	0.643	0.688	0.738	0.792	0.850	0.912	0.980		
February 12, a. m					1.029	1.119	1.217		
February 15, a. m						0.986	1.165	1.376	
February 15, p. m			1.003	1.057	1.132	1.211	1.297	1.387	
February 18, a. m					1.154	1.248	1.337		
February 25, p. m				0.512	0.589	0.695	0.848	1.170	
March 2, p. m					1.064	1.133	1.206	1.282	
March 15, p. m		0.702	0.765	0.835	0.928	1.024	1.131	1.308	
March 20, p. m			0.884	0.950	1.022	1.107	1.197	1.299	
March 23, p. m						0.780	0.922		
March 25, p. m					1.022	1.108	1.200	1.300	
March 29, p. m						0.615	0.756		
March 30, a. m							1.020		
April 2, a. m					1.107	1.188	1.276	1.370	1.471
April 2, p. m					1.005	1.097	1.197	1.306	
April 3, a. m							0.846	1.112	
April 3, p. m						0.674	0.813	0.982	
April 24, p. m							1.018	1.163	1.328
April 25, a. m						0.749	0.871	1.014	
April 25, p. m					0.805	0.893	0.991	1.099	1.210
May 13, a. m						0.840	0.965	1.110	1.276
May 13, p. m					0.745	0.855	0.982	1.128	
May 14, p. m							0.901	1.052	1.192
May 21, p. m							0.874	1.070	
May 22, a. m								0.783	
June 17, p. m								0.520	0.755
July 1, p. m								0.836	
July 27, a. m						0.918	1.034	1.165	1.313
July 31, a. m								1.084	
July 31, p. m								1.005	
August 2, p. m								0.950	
October 2, p. m				0.781	0.852	0.931	1.033	1.146	
October 7, p. m						0.860	0.971	1.098	
October 8, p. m	0.668	0.786	0.850	0.916	0.993	1.085	1.185		
October 9, a. m					0.975	1.062	1.158		
October 9, p. m		0.702	0.743		0.837		1.060	1.182	
October 10, p. m		0.469		0.621	0.714	0.821	0.944	1.085	
October 15, p. m	0.407	0.469	0.539	0.620	0.712	0.818	0.941	1.081	
November 15, p. m	0.451	0.511	0.578	0.655	0.741		0.951		
December 5, p. m	0.568		0.805	0.886	0.959	1.008	1.122		
December 6, p. m	0.612	0.682	0.724	0.786	0.855	0.930	1.012		
December 31, p. m	0.797	0.861	0.929	1.002	1.081	1.167	1.259		
1908.									
January 3, p. m	0.422	0.474	0.534	0.599	0.673	0.822			
January 9, p. m	0.754	0.773	0.836	0.904	0.978	1.059	1.146		
January 14, p. m	0.721	0.787	0.858	0.937	1.023	1.117	1.220		
January 17, a. m						0.717	1.012		
January 17, p. m			0.683	0.742	0.921	1.020			
January 30, a. m			0.907	0.980	1.060	1.145	1.238		
January 30, p. m			0.952	1.022	1.098	1.180	1.267		
February 6, p. m					0.825	0.953	1.047		
February 8, a. m						1.086			
February 8, p. m				0.949	1.037	1.118	1.241	1.357	
April 4, p. m						0.846	0.977	1.131	
April 11, p. m				0.883	0.978	1.082	1.198	1.301	
April 13, p. m								1.043	
April 16, p. m			0.783	0.811	0.900	0.998	1.106	1.257	1.403
April 17, a. m					0.735	0.828	0.934	1.052	
April 21, p. m					0.817	0.940	1.081	1.243	1.428
April 29, p. m						0.845	0.979	1.133	1.312
May 1, a. m						0.908	1.038	1.185	
May 26, p. m									1.268
June 2, a. m					0.856	0.959	1.073	1.201	1.345
June 8, p. m					0.696	0.806	0.934	1.081	1.301
June 16, p. m					0.923	1.018	1.111	1.197	1.320
June 24, p. m								1.036	1.193
June 27, a. m					0.740	0.754	0.901	1.052	1.268

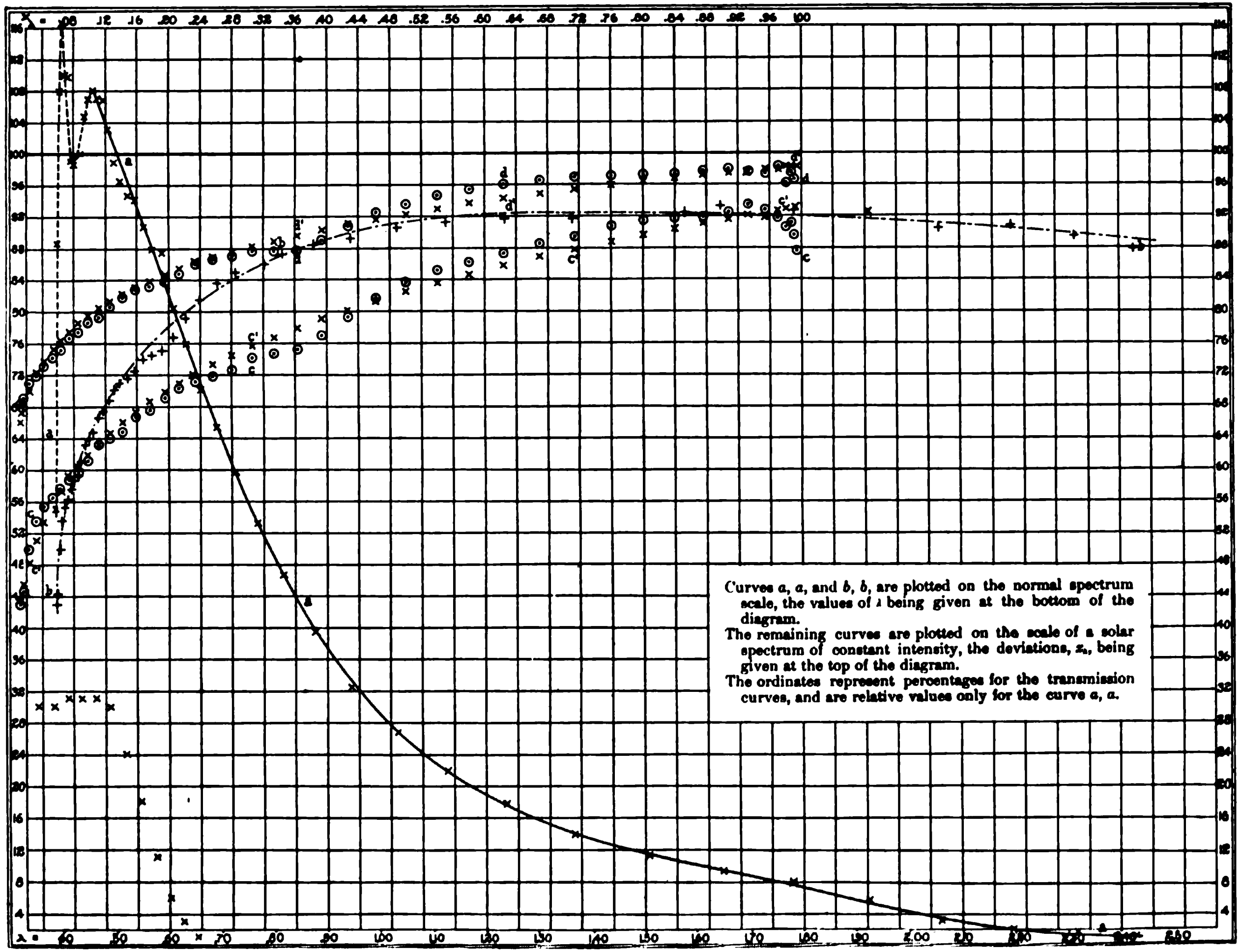

FIG. 1.—Atmospheric transmissibility and solar spectrum energy curves.

The data in Table 1 show the actual variations that occur in the amount of solar radiation that reaches the surface of the earth on clear days. In Table 2 the pyrheliometer readings have been reduced to the Smithsonian actinometric standard by means of the ratios given in Table 6, Comparison of pyrheliometers, and also to mean solar distance. These data, therefore, more clearly show the effects of the seasonal variations in atmospheric transparency than do the data in Table 1. The readings are reduced to the Smithsonian standard in order that the values of the solar constant that are to be computed may be comparable with the values that have been published by Mr. Abbot and Mr. Fowle of the Smithsonian Institution.[2]

In fig. 1, *a*, *a*, is the intensity curve for the normal solar spectrum outside the earth's atmosphere, as derived from Abbot's Mount Wilson determinations,[3] and *b*, *b*, is a curve showing the mean vertical transmission of the atmosphere at Washington,[4] also plotted on the normal spectrum scale.

TABLE, 2—*Washington pyrheliometer readings reduced to the Smithsonian actinometric standard, and to mean solar distance.*

Date.	Air mass.								
	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
1905.									
December 22, p. m.	......	......	......	......	1.095	1.194	1.302	......	......
December 26, p. m.	0.853	0.909	0.969	1.032	1.090	1.187	1.290	......	......
1906.									
January 9, p. m.	......	0.827	0.915	1.013	1.122	1.238	1.374	......	......
January 10, p. m.	0.936	0.980	1.028	1.101	1.179	1.263	1.352	......	......
January 29, p. m.	......	......	......	1.003	1.080	1.192	1.324	......	......
January 30, p. m.	......	......	......	0.695	0.835	0.922	1.048	......	......
February 13, p. m.	......	0.932	0.998	1.074	1.151	1.249	1.340	1.441	......
February 15, p. m.	......	......	1.028	1.101	1.186	1.280	1.390	1.510	......
March 22, p. m.	......	......	......	......	1.014	1.118	1.223	1.340	......
April 2, p. m.	......	......	......	......	1.087	1.194	1.311	1.439	......
April 17, a. m.	......	......	......	......	......	0.952	1.090	1.243	1.420
April 17, p. m.	......	......	......	......	......	0.969	1.071	1.229	1.409
April 18, a. m.	......	......	......	......	......	......	1.076	1.251	1.456
May 18, p. m.	......	......	......	......	......	0.786	0.882	1.058	1.267
May 29, a. m.	......	......	......	......	......	1.116	1.252	1.405	1.576
May 29, p. m.	......	......	......	......	......	1.207	1.288	1.420	1.569
September 25, p. m	......	......	......	......	......	......	1.157	1.250	......
October 8, p. m	......	......	......	......	0.936	1.066	1.212	1.379	......
October 12, p. m	0.859	0.918	0.980	1.046	1.117	1.193	1.274	1.360	......
October 15, p. m	......	......	0.867	0.949	1.038	1.144	1.266	1.402	......
November 1, p. m.	0.876	0.944	1.018	1.099	1.185	1.286	1.404	1.545	......
November 2, a. m.	......	......	......	......	1.204	1.291	1.384	1.483	......
November 2, p. m.	0.859	0.927	1.002	1.081	1.167	1.260	1.360	1.468	......
November 3, a. m	......	......	......	......	1.235	1.320	1.410	1.506	......
November 3, p. m	0.921	0.987	1.060	1.136	1.209	1.306	1.412	1.526	......
November 6, a. m.	......	......	......	......	1.190	1.211	1.338	1.497	......
November 6, p. m	0.815	0.890	0.972	1.060	1.158	1.264	1.380	1.520	......
November 7, a. m.	......	......	......	......	1.255	1.335	1.418	1.506	......
November 7, p. m.	0.810	0.883	0.963	1.050	1.144	1.247	1.359	1.481	......
November 22, p. m.	0.990	1.044	1.102	1.162	1.234	1.316	1.403	......	......
November 24, p. m.	......	......	0.694	0.776	0.870	0.968	......	......	......
November 27, p. m.	0.683	0.761	0.847	......	......	......	1.298	......	......

[2] Annals of the Astrophysical Observatory of the Smithsonian Institution, Vol. II, p. 96–98.

[3] Ibid., p. 105. For convenience in plotting, Abbot's figures for the mean intensity, normal scale, have been multiplied by 0.06.

[4] Ibid., p. 113.

TABLE 2.—*Washington pyrheliometer readings, etc.*—Continued.

Date.	Air mass.								
	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
1907.									
January 21, p. m	0.908	0.969	1.033	1.104	1.185	1.276	1.373	....	....
January 23, p. m	....	0.984	1.058	1.128	1.209	1.294	1.411	....	....
January 28, a. m	....	....	....	....	0.840	0.948	1.069	....	....
January 28, p. m	0.691	0.741	0.795	0.854	0.916	0.983	1.056	....	....
February 12, a. m	....	....	....	....	1.114	1.212	1.318	....	....
February 15, a. m	....	....	....	....	....	1.069	1.264	1.491	....
February 15, p. m	....	....	1.088	1.146	1.227	1.313	1.406	1.503	....
February 18, a. m	....	....	....	....	1.255	1.349	1.452	....	....
February 25, p. m	....	....	....	0.577	0.641	0.757	0.924	1.274	....
March 2, p. m	....	....	....	....	1.162	1.237	1.316	1.400	....
March 15, p. m	....	0.772	0.841	0.917	1.020	1.126	1.243	1.437	....
March 20, p. m	....	....	0.975	1.047	1.127	1.220	1.320	1.432	....
March 23, p. m	....	....	....	....	....	0.861	1.041	....	....
March 25, p. m	....	....	....	....	1.130	1.224	1.326	1.437	....
March 29, p. m	....	....	....	....	....	0.681	0.838	....	....
March 30, a. m	....	....	....	....	....	....	1.130	....	....
April 2, a. m	....	....	....	....	1.229	1.320	1.417	1.521	1.634
April 2, p. m	....	....	....	....	1.132	1.236	1.348	1.471	....
April 3, a. m	....	....	....	....	....	....	0.939	1.236	....
April 3, p. m	....	....	....	....	....	0.760	0.916	1.106	....
April 24, p. m	....	....	....	....	....	....	1.145	1.308	1.493
April 25, a. m	....	....	....	....	....	0.842	0.980	1.141	....
April 25, p. m	....	....	....	....	0.906	1.005	1.115	1.237	1.371
May 13, a. m	....	....	....	....	....	0.953	1.095	1.260	1.448
May 13, p. m	....	....	....	....	0.845	0.971	1.115	1.281	....
May 14, p. m	....	....	....	....	....	....	1.023	1.195	1.353
May 21, p. m	....	....	....	....	....	....	0.935	1.218	....
May 22, a. m	....	....	....	....	....	....	....	0.891	....
June 17, p. m	....	....	....	....	....	....	....	0.596	0.865
July 1, p. m	....	....	....	....	....	....	....	0.960	....
July 27, a. m	....	....	....	....	....	1.051	1.184	1.335	1.505
July 31, a. m	....	....	....	....	....	....	....	1.241	....
July 31, p. m	....	....	....	....	....	....	....	1.150	....
August 2, p. m	....	....	....	....	....	....	....	1.086	....
October 2, p. m	....	....	....	0.865	0.948	1.012	1.149	1.274	....
October 7, p. m	....	....	....	....	....	0.954	1.077	1.218	....
October 8, p. m	0.741	0.872	0.943	1.026	1.101	1.203	1.314	....	....
October 9, a. m	....	....	....	....	1.080	1.177	1.284	....	....
October 9, p. m	....	0.778	0.828	....	0.927	....	1.175	1.310	....
October 10, p. m	....	0.520	....	0.688	0.790	0.909	1.045	1.201	....
October 15, p. m	0.450	0.518	0.595	0.684	0.786	0.904	1.038	1.194	....
November 15, p. m	0.490	0.555	0.628	0.711	0.805	....	1.034	....	....
December 5, p. m	0.613	....	0.869	0.934	1.034	1.087	1.210	....	....
December 6, p. m	0.660	0.735	0.781	0.848	0.923	1.003	1.092	....	....
December 31, p. m	0.860	0.928	1.002	1.081	1.167	1.259	1.358	....	....
1908.									
January 3, p. m	0.453	0.510	0.578	0.644	0.723	0.882	....	....	....
January 9, p. m	0.810	0.830	0.858	0.971	1.050	1.137	1.231	....	....
January 14, p. m	0.775	0.846	0.923	1.007	1.099	1.200	1.311	....	....
January 17, a. m	....	....	....	....	....	0.771	1.088	....	....
January 17, p. m	....	....	0.735	0.797	0.990	1.097	....	....	....
January 30, a. m	....	....	0.978	1.057	1.143	1.234	1.334	....	....
January 30, p. m	....	....	1.026	1.102	1.184	1.272	1.366	....	....
February 6, p. m	....	....	....	....	0.891	1.029	1.131	....	....
February 8, a. m	....	....	....	....	....	1.175	....	....	....
February 8, p. m	....	....	....	1.026	1.121	1.209	1.341	1.467	....
April 4, p. m	....	....	....	....	....	0.941	1.087	1.258	....
April 11, p. m	....	....	....	0.986	1.092	1.209	1.338	1.452	....
April 13, p. m	....	....	....	....	....	....	....	1.166	....
April 16, p. m	....	....	0.821	0.908	1.008	1.118	1.238	1.407	1.570
April 17, a. m	....	....	....	....	0.823	0.928	1.046	1.179	....
April 21, p. m	....	....	....	....	0.917	1.056	1.214	1.395	1.603
April 29, p. m	....	....	....	....	....	0.954	1.104	1.278	1.479
May 1, a. m	....	....	....	....	....	1.025	1.172	1.340	....
May 26, p. m	....	....	....	....	....	....	....	....	1.447
June 2, a. m	....	....	....	....	0.979	1.096	1.227	1.374	1.538
June 8, p. m	....	....	....	....	0.797	0.928	1.069	1.237	1.489
June 16, p. m	....	....	....	....	1.058	1.161	1.274	1.378	1.514
June 24, p. m	....	....	....	....	....	....	....	1.189	1.370
June 27, a. m	....	....	....	....	0.850	0.866	1.034	1.208	1.456

As suggested by Ångström[5], if we express the coefficient of general atmospheric transmission for any wave length by the equation

$$y_\lambda = \varphi(\lambda) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

and the corresponding intensity of solar radiation by

$$I_\lambda = \Psi(\lambda) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

then the radiation received at the surface of the earth after the solar rays have past thru an atmospheric diffusing layer of thickness m will be exprest by

$$Q_m = \int_{\lambda_1}^{\lambda_2} \Psi(\lambda)\,[\varphi(\lambda)]^m d\lambda \quad \ldots\ldots\ldots\ldots\ldots \quad (3)$$

Since the function $\Psi(\lambda)$ is not exprest by any known law, the problem may be simplified by assuming a dispersion, x, that will give a solar spectrum of constant intensity.

If we were able to integrate the equation of the curve a, a,

$$\int_{\lambda_1}^{\lambda_2} I_\lambda = \int_{\lambda_1}^{\lambda_2} \Psi(\lambda)\,d\lambda,$$

the ratios between the integrals for successive values of λ and the integral for the total range of wave lengths in the solar spectrum would give the relative quantities of radiant energy, or heat, received by the earth from different parts of the solar spectrum. These ratios would also give the relative distances on the axis of x between the corresponding values of λ, or the deviations, x_λ, in a spectrum of constant intensity. A graphical integration has been effected by counting the number of squares on millimeter cross-section paper included between the portions of the curve a, a and the axis of x corresponding to the values of λ given in Table 3. Following Abbot[6] there has been added to the total number of squares included between the limits $\lambda = 0.387\,\mu$ and $\lambda = 2.428\,\mu$, 1.3 per cent for ultraviolet radiation and 0.55 per cent for infra-red radiation, outside these limits. In column 2 of Table 3 are given the deviations of x_λ thus computed, and in columns 3 and 5 are given Abbot's[7] corresponding values of the mean atmospheric transmission above Washington and above Mount Wilson, as derived from bolometric observations. These latter are also plotted, on fig. 1, as the ordinates of the curves c, c and d, d, the abscissas, x_λ, representing the deviations in the spectrum of constant intensity.

[5] Méthode nouvelle pour l'étude de la radiation solaire par Knut Ångström. Nova Acta Regiæ Societatis Scientiarum Upsaliensis. Ser. IV. Vol. 1, N. 7.

[6] Ibid., p. 56. [7] Ibid., p. 111 and 113.

TABLE 3.—*Vertical transmission of atmosphere.*

λ	x_λ	Above Washington.		Above Mount Wilson.	
		Observed.	Computed.	Observed.	Computed.
μ 0.387	0.0183	0.430	0.438	0.6844	0.6599
0.390	0.0171	0.445	0.454	0.6897	0.6754
0.3942	0.0245	0.499	0.482	0.7090	0.6961
0.3987	0.0334	0.535	0.510	0.7180	0.7183
0.4037	0.0435	0.553	0.533	0.7301	0.7360
0.4091	0.0541	0.564	0.555	0.7411	0.7509
0.4147	0.0641	0.575	0.572	0.7504	0.7627
0.4210	0.0751	0.587	0.588	0.7654	0.7739
0.4275	0.0866	0.594	0.603	0.7728	0.7841
0.4343	0.0987	0.611	0.617	0.7852	0.7936
0.4417	0.1122	0.631	0.631	0.7917	0.8030
0.4494	0.1267	0.639	0.646	6.8054	0.8120
0.4578	0.1427	0.647	0.659	0.8165	0.8210
0.4666	0.1595	0.666	0.672	0.8274	0.8294
0.4762	0.1777	0.674	0.685	0.8308	0.8377
0.4861	0.1962	0.689	0.697	0.8378	0.8454
0.4974	0.2144	0.702	0.708	0.8469	0.8523
0.5094	0.2352	0.710	0.720	0.8591	0.8596
0.5226	0.2576	0.717	0.732	0.8645	0.8668
0.5370	0.2818	0.725	0.743	0.8683	0.8740
0.5525	0.3073	0.740	0.755	0.8751	0.8810
0.5697	0.3346	0.745	0.766	0.8742	0.8879
0.5889	0.3641	0.751	0.778	0.8785	0.8948
0.6098	0.3948	0.768	0.789	0.8890	0.9015
0.6333	0.4280	0.791	0.800	0.9068	0.9082
0.6610	0.4636	0.815	0.812	0.9235	0.9149
0.6925	0.5013	0.835	0.823	0.9340	0.9216
0.7280	0.5408	0.850	0.834	0.9449	0.9280
0.7690	0.5819	0.860	0.845	0.9522	0.9343
0.818	0.6250	0.871	0.856	0.9588	0.9404
0.877	0.6707	0.883	0.867	0.9631	0.9466
0.946	0.7148	0.892	0.876	0.9675	0.9521
1.034	0.7610	0.906	0.886	0.9687	0.9576
1.127	0.8010	0.912	0.894	0.9706	0.9621
1.239	0.8407	0.915	0.902	0.9711	0.9664
1.367	0.8769	0.917	0.909	0.9746	0.9702
1.508	0.9082	0.923	0.914	0.9775	0.9733
1.648	0.9337	0.933	0.919	0.9756	0.9758
1.786	0.9545	0.926	0.922	0.9724	0.9778
1.924	0.9709	0.916	0.925	0.9800	0.9793
2.060	0.9817	0.904	0.927	0.9600	0.9803
2.196	0.9880	0.909	0.928	0.9740	0.9809
2.316	0.9919	0.894	0.929	0.9649	0.9812
2.428	0.9945	0.875	0.929	0.9251	0.9815

Equation (3) may now be exprest in the form—

$$Q_m = \int_{x_1}^{x_2} [\varphi(x)]^m \, dx \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

and equation (1) may be written

$$y_x = \varphi(x) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Assuming that $\varphi(x)$ has the exponential form, we may express (5) by

$$y_x = px^n \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

Substituting for y_x the mean atmospheric transmission factors for Washington, given in column 3 of Table 3, and solving equation (6) by the least-squares method, we obtain

$$y_x = 0.93x^{0.18} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7)$$

Similarly, substituting the mean atmospheric transmission above Mount Wilson given in column 5 of Table 3, we obtain

$$y_x = 0.98 x^{0.09} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

The difference in the constants of these two equations is without doubt due to the difference in the general atmospheric absorption, viz, the scattering by the gas molecules and dust particles, above the two observing points. The transmission is the complement of the absorption, and Ångström suggests that we consider the general transmission as depending on the density of the atmospheric diffusing layer. Representing this density by δ, we may introduce this term in equation (6) as follows:

$$y_x = p^{\delta} \, x^{n\varphi(\delta)} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

Assuming that for the mean conditions at Washington $\delta = 1$, from equations (7) and (8), we find that for the mean conditions at Mount Wilson $\delta = 0.25$, and $\varphi(\delta) = \delta^{\frac{1}{2}}$.

Equations (7) and (8) may therefore be exprest by the general equation

$$y_x = 0.93^{\delta} \, x^{0.18\delta^{\frac{1}{2}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (10)$$

In columns 4 and 6 of Table 3 are given the computed transmission coefficients when $\delta = 1$ and 0.25, respectively. These values have been plotted on fig. 1 as the ordinates of the curves c', c' and d', d', respectively.

It therefore appears that this equation enables us to compute the general atmospheric transmission corresponding to any wave length and to densities of the diffusing atmospheric layer representing the mean conditions at Washington and at Mount Wilson. The equation is now to be tested to see if it is applicable to other values of δ.

For observations thru any air mass m, equation (10) takes the form

$$y_x^m = 0.93^{m\delta} \, x^{0.18m\delta^{\frac{1}{2}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (11)$$

Integrating this equation between the limits $x=0$ and $x=1$, and at the same time multiplying by the solar constant, since we have assumed the ordinate of our spectrum of constant intensity to be 1, we obtain

$$Q'_m = Q_0 \int_{x_0}^{x_1} 0.93^{m\delta} \left(x^{0.18m\delta^{\frac{1}{2}}}\right) dx = Q_0 \frac{0.93^{m\delta}}{1 + 0.18\, m\delta^{\frac{1}{2}}} \,, \quad \ldots\ldots \quad (12)$$

where Q'_m = the total radiation that would be received at the surface of the earth after it had been depleted by passing thru a diffusing atmospheric layer of thickness m and density δ, disregarding the losses due to such absorption by gases as is represented by the bands of the solar spectrum.

Abbot[8] states that the percentage of depletion of solar radiation due to absorption by water vapor above Mount Wilson may be exprest by the equation

$$F_w = 5.7 + 0.12\ E_w m \qquad (13)$$

and above Washington by

$$F_0 = 5.2 + 0.12\ E_0 m \qquad (14)$$

He also states that the difference between the first terms of the second members of these two equations is probably due to the fact that "Owing to the general absorption being greater above Washington than above Mount Wilson there is less radiation available to be absorbed by water vapor above Washington."

In other words,

$$F_0 = \varphi(\delta) + 0.12\ E_0 m \qquad (15)$$

where $E_0 = 2.3\ e_0$ represents the depth in millimeters to which the earth's surface would be covered by water if all the aqueous vapor were precipitated, e_0 representing the vapor pressure at sea level in millimeters.

Equation (15) takes the form

$$F_0 = (5.9 - 0.8\delta) + 0.12\ E_0 m \qquad (16)$$

Equation (16) does not allow for the slight band absorption by atmospheric gases other than water vapor. From an examination of bolograms made at the Astrophysical Observatory, Washington, this apparently amounts to only about 0.2 per cent of the solar radiation.

The total band absorption may, therefore, be exprest by

$$F_0' = Q_0\left[(.061 - .008\ \delta) + .0012\ E_0 m\right] \qquad (17)$$

Subtracting equation (17) from equation (12) we obtain

$$Q_m = Q_0\left(\frac{0.93^{m\delta}}{1 + 0.18 m\delta^{1/4}} - \left[(.061 - .008\delta) + .0012 E_0 m\right]\right) \qquad (18)$$

Equation (18) represents the total radiation received at the surface of the earth after the rays have been depleted both by general atmospheric absorption or scattering and also by selective gas absorption. From observations thru two air masses, as thru m and $m+1$, we obtain

$$\frac{Q_{m+1}}{Q_m} = \frac{\dfrac{0.93^{\delta(m+1)}}{1+0.18(m+1)\delta^{1/4}} - \left[(.061 - .008\delta) + .0012\ E_0(m+1)\right]}{\dfrac{0.93^{\delta m}}{1+0.18 m\delta^{1/4}} - \left[(.061 - .008\delta) + .0012\ E_0 m\right]} \qquad (19)$$

from which δ may be computed. Having determined δ, the solar constant is found at once from equation (18) in the form

[8] Ibid., p. 130.

$$Q_0 = \frac{Q_m}{\dfrac{0.93^{\delta m}}{1+0.18m\delta^{1/2}} - \left[(.061-.008\delta)+.0012\ E_0 m\right]} \cdots\cdots \quad (20)$$

TABLE 4.—*Ratio,* Q_3 / Q_2.

δ	e_0 (mm).					
	1.0	2.0	3.0	4.0	5.0	6.0
0.25	.900	.895	.891	.887	.882	.877
0.30	.890	.885	.881	.876	.871	.865
0.35	.883	.878	.873	.868	.863	.857
0.40	.876	.870	.865	.860	.855	.849
0.45	.868	.862	.857	.852	.847	.841
0.50	.861	.855	.850	.844	.839	.833
0.55	.854	.848	.842	.836	.831	.825
0.60	.847	.841	.835	.830	.824	.817
0.65	.841	.835	.829	.824	.817	.810
0.70	.836	.829	.823	.817	.811	.804
0.75	.829	.822	.816	.810	.804	.796
0.80	.823	.815	.809	.803	.797	.789
0.85	.817	.809	.803	.796	.790	.782
0.90	.811	.803	.797	.790	.783	.775
0.95	.805	.797	.791	.784	.777	.769
1.00	.800	.792	.785	.778	.771	.763
1.05	.796	.788	.780	.773	.766	.758
1.10	.791	.783	.775	.768	.761	.753
1.15	.786	.778	.771	.763	.756	.748
1.20	.781	.773	.766	.758	.750	.742
1.25	.776	.768	.760	.752	.744	.736

TABLE 5.—*Evaluation of* $\dfrac{0.93^{2\delta}}{1+0.36\,\delta^{\frac{1}{2}}} - F'_0$

δ	e_0 (mm).					
	1.0	2.0	3.0	4.0	5.0	6.0
0.25	.749	.744	.738	.733	.727	.722
0.30	.733	.728	.722	.717	.711	.706
0.35	.718	.713	.707	.702	.696	.691
0.40	.703	.698	.692	.687	.681	.676
0.45	.690	.685	.679	.674	.668	.663
0.50	.678	.673	.667	.662	.656	.651
0.55	.666	.661	.655	.650	.644	.639
0.60	.655	.650	.644	.639	.633	.628
0.65	.644	.639	.633	.628	.622	.617
0.70	.634	.629	.623	.618	.612	.607
0.75	.624	.619	.613	.608	.602	.597
0.80	.614	.609	.603	.598	.592	.587
0.85	.606	.601	.595	.590	.584	.579
0.90	.597	.592	.586	.581	.575	.570
0.95	.589	.584	.578	.573	.567	.562
1.00	.580	.575	.569	.564	.558	.553
1.05	.572	.567	.561	.556	.550	.545
1.10	.564	.559	.553	.548	.542	.537
1.15	.556	.551	.545	.540	.534	.529
1.20	.549	.544	.538	.533	.527	.522
1.25	.542	.537	.531	.526	.520	.515

Table 4 is a section of a more extensive table that has been computed, giving the values of $\frac{Q_{m+1}}{Q_m}$ where $m = 2$, for values of δ ranging from 0.20 to 2.20, and for values of e_0 ranging from 0.25 to 20.0 millimeters. Table 5 is a section of a similar table giving the values of the denominator of the second member of equation (20) corresponding to the range of values for δ and e_0 indicated above. As an illustration of the use of these tables, from Table 2 it is seen that on December 22, 1905, the ratio $\frac{Q_3}{Q_2} = \frac{1.095}{1.302} = 0.841$. From observation, $e_0 = 4.17$, and from Table 4, the value of δ corresponding to these values of $\frac{Q_3}{Q_2}$ and e_0 is found to be 0.514. From Table 5 the value of $\frac{0.93^{2\delta}}{1+0.36\,\delta^{\frac{1}{4}}} - F_0'$ corresponding to $\delta = 0.514$ and $e_0 = 4.17$, is 0.658, and consequently, $Q_0 = \frac{Q_2}{0.658} = \frac{1.302}{0.658} = 1.979$.

By similar computations the value of the solar constant has been determined from observations made with the Ångström pyrheliometer at the Central Office in Washington on sixty-nine different occasions between December 22, 1905, and June 30, 1908, generally on different days but occasionally in the morning and again in the afternoon of the same day. These values are given in column 5 of Table 6. The mean value is 2.015, or within 0.3 per cent of the mean value computed by Abbot from bolometric observations made on Mount Wilson.[9] The highest value obtained was 2.335 on April 21, 1908, and the lowest value was 1.812 on April 17, 1908. On neither of these days were the meteorological conditions considered good. On the afternoon of April 21, while the observations plotted very nearly in a straight line, there was a tendency to convexity rather than to concavity, indicating that the atmospheric transmission became less as the day advanced. There was also a steady falling off in the percentage of polarization of blue sky light,[10] while usually it increases as the sun approaches the horizon. On the morning of April 17 observations were discontinued at 9 a. m. on account of the approach of cirrus clouds. It is therefore probable that on this day also, altho the pyrheliometric observations plotted in a fairly straight line, the atmospheric transmission was steadily de-

[9] Ibid., p. 96 and 97.

[10] For a brief reference to the relation between atmospheric transmission and the percentage of polarization of blue sky light, see Proceedings of the Third Convention of Weather Bureau Officials, held at Peoria, Ill., September, 1904, p. 69–73. The subject will be more fully considered at another time.

creasing. Diminishing atmospheric transmission during the afternoon hours will cause the computed value of the solar constant to be too high, while diminishing atmospheric transmission during the morning hours will cause the computed value of the solar constant to be too low. Correct values can be obtained only when the atmospheric conditions are constant during the period of observation, which is usually about two hours.

On only five occasions did the computed value of the solar constant exceed 2.15 and on only six occasions was it less than 1.90. In most cases the departure from the mean value does not exceed 3 per cent.

TABLE 6.—*Solar constant computations from Washington observations.*

Date.	Q_3/Q_2	e_0	δ	Q_0 (W. B.)	Q_0 (Fowle.)	Relative weight.	Quadrant.		Wind.	
							High area.	Low area.	Dir.	Vel.
1905.										
December 22, p. m.	0.841	4.17	0.514	1.979	2.068	4	9	....	sw.	12
December 26, p. m.	0.845	2.87	0.540	1.960	2.089	5	3	....	s.	8
1906.										
January 9, p. m.	0.817	1.96	0.785	2.249	2.318	3	16	....	nw.	18
January 10, p. m.	0.872	1.32	0.415	1.940	1.996	4	3	....	s.	9
January 29, p. m.	0.816	8.30	0.735	2.153	2.176	8	5	....	nw.	5
January 30, p. m.	0.773	5.86	0.960	1.858	2.050	2	....	13	s.	12
February 13, p. m.	0.859	4.17	0.400	1.953	2.016	6	2	4	nw.	9
February 15, p. m.	0.853	2.16	0.510	2.075	2.128	6	15	12	nw.	16
March 22, p. m.	0.829	1.78	0.710	1.947	1.999	6	15	....	nw.	18
April 2, p.m.	0.829	2.62	0.660	2.071	2.136	6	7	....	nw.	13
April 17, a. m.	0.766	4.57	1.080	1.989	2.081	9	2	....	nw.	12
April 17, p. m.	0.760	4.44	1.150	1.994	2.081	9	2	....	nw.	12
April 18, a. m.	0.789	4.80	1.315	2.100	2.211	5	2	....	nw.	7
May 18, p. m.	0.696	8.50	1.395	1.838	2.000	8	8	....	nw.	6
May 29, a. m.	0.794	6.50	0.750	2.104	2.229	9	14	20	nw.	17
May 29, p. m.	0.821	9.90	0.440	2.000	2.146	7	6	....	nw.	12
October 15, p. m.	0.819	7.06	0.555	2.006	2.012	4	11	....	ne.	10
November 1, p. m.	0.844	3.20	0.530	2.131	2.166	5	14	....	nw.	11
November 2, a. m.	0.870	3.45	0.355	1.966	2.054	4	2	....	nw.	9
November 2, p. m.	0.858	3.68	0.420	1.991	2.073	8	2	....	nw.	9
November 3, a. m.	0.876	4.57	0.290	1.966	2.062	4	14	....	nw.	7
November 3, p. m.	0.857	3.38	0.440	2.076	2.081	8	14	....	nw.	6
November 6, a. m.	0.822	4.95	0.620	2.129	2.201	5	14	....	n.	10
November 6, p. m.	0.839	3.68	0.545	2.113	2.201	8	14	....	nw.	10
November 7, a. m.	0.886	8.15	0.270	1.942	2.030	1	2	....	nw.	10
November 7, p. m.	0.842	8.02	0.550	2.075	2.155	6	2	....	nw.	9
November 22, p. m.	0.879	4.95	0.265	1.942	2.014	6	15	....	nw.	14
November 27, p. m.	0.807	4.57	0.750	2.145	2.232	2	....	12	nw.	18
1907.										
January 21, p. m.	0.863	1.75	0.455	2.004	2.063	5	7	....	nw.	12
January 23, p. m.	0.857	0.99	0.530	2.101	2.064	4	14	....	nw.	7
January 28, a. m.	0.786	1.45	1.105	1.902	1.948	1	7	....	nw.	7
February 12, a. m.	0.845	0.91	0.620	2.024	2.067	1	7	....	nw.	9
February 15, p. m.	0.873	1.45	0.400	2.006	2.070	5	16	....	nw.	7
February 18, a. m.	0.863	1.32	0.480	2.129	2.241	1	5	....	nw.	7
February 25, p. m.	0.694	2.79	1.960	2.076	2.122	1	14	....	nw.	10
March 2, p. m.	0.883	4.44	0.255	1.920	1.925	2	16	....	nw.	9
March 15, p. m.	0.820	8.38	0.710	2.008	2.074	2	7	....	nw.	6
March 20, p. m.	0.854	3.62	0.450	1.958	2.033	3	14	....	nw.	9
March 23, p. m.	....	7.62	....	....	2.283	1	17	....	s.	4
March 25, p. m.	0.852	4.50	0.440	1.970	2.055	2	12	....	se.	4
March 29, p. m.	....	9.96	....	....	2.118	1	16	....	se.	4
April 2, a. m.	0.867	2.36	0.410	2.089	2.121	8	2	....	n.	10
April 2, p. m.	0.840	1.80	0.620	2.083	2.121	4	2	....	n.	5
April 3, p. m.	....	8.33	....	....	2.195	1	2	....	nw.	4
April 24, p. m.	....	3.66	....	....	2.192	2	7	....	nw.	18
April 25, a. m.	0.739	6.76	1.175	1.881	2.014	2	8	....	s.	10
April 25, p. m.	....	6.27	....	....	1.893	1	8	....	s.	18

TABLE 6.—*Solar constant computations from Washington observations*—Continued.

Date.	Q_3/Q_2.	e_0	δ	Q_0 (W. B.)	Q_0 (Fowle.)	Relative weight.	Quadrant.		Wind.	
							High area.	Low area.	Dir.	Vel.
1907.										
May 13, a. m.	0.757	7.57	0.965	1.991	2.174	10	4	....	s.	8
May 13, p. m.	0.758	6.76	1.000	2.035	2.174	10	4	....	s.	12
May 14, p. m.	....	12.21	....	....	2.131	1	3	....	s.	9
June 17, p. m.	....	11.35	....	....	2.063	1	2	....	sw.	5
July 27, a. m.	0.787	9.47	0.660	1.987	2.145	3	7	3	nw.	12
July 31, a. m.	....	12.68	....	....	2.068	1	....	12	nw.	7
October 8, p. m.	0.838	6.27	0.460	1.997	2.097	3	15	20	nw.	22
October 9, a. m.	0.841	5.16	0.480	1.945	2.032	2	1	....	ne.	7
October 9, p. m.	0.789	3.00	0.965	2.043	2.032	1	1	....	s.	5
October 10, p. m.	0.756	8.18	0.945	1.900	2.051	3	....	13	se.	7
October 15, p. m.	0.757	5.36	1.110	1.922	2.082	4	2	....	nw.	8
November 15, p. m.	0.779	3.45	1.020	1.837	1.916	2	12	....	s.	8
December 31, p. m.	0.859	1.69	0.485	2.000	2.064	4	7	....	nw.	12
1908.										
January 9, p. m.	0.858	1.45	0.535	1.843	1.899	2	16	20	nw.	27
January 14, p. m.	0.839	2.49	0.590	2.018	2.091	3	16	....	nw.	20
January 30, a. m.	0.856	1.02	0.535	1.994	2.046	8	5	....	nw.	14
January 30, p. m.	0.867	1.07	0.460	1.988	2.046	7	5	....	nw.	10
February 6, p. m.	0.787	3.30	0.965	1.970	2.041	3	....	5	nw.	9
February 8, p. m.	0.836	1.52	0.670	2.102	2.149	4	5	....	nw.	14
April 4, p. m.	0.748	1.96	1.440	2.127	2.185	1	8	....	nw.	15
April 11, p. m.	0.816	3.15	0.740	2.179	2.254	1	15	20	nw.	26
April 16, p. m.	0.814	2.74	0.775	2.031	2.203	4	14	....	ne.	11
April 17, a. m.	0.787	3.81	0.930	1.812	1.898.	2	4	....	se.	6
April 21, p. m.	0.755	1.96	1.870	2.335	2.378	5	6	....	nw.	17
April 29, p. m.	0.746	4.75	1.250	2.115	2.224	3	....	20	s.	8
May 1, a. m.	0.765	3.63	1.160	2.170	2.246	1	16	5	nw.	17
June 2, a. m.	0.798	8.18	0.650	2.028	2.166	3	6	....	nw.	7
June 8, p. m.	0.745	12.68	0.763	1.983	2.154	1	8	....	se.	8
June 16, p. m.	0.832	7.87	0.450	1.948	2.070	2	6	....	nw.	9
June 27, a. m.	0.710	13.61	0.955	1.992	2.192	2	2	....	sw.	3
Means	....	....	....	2.015	2.099	....	....	....	....	....

In column 6 of Table 6 are given the values of the solar constant, computed from Fowle's formula.[11] The pyrheliometric observations were extrapolated to zero atmosphere by means of the straght line that appeared to best fit them, as shown in figs. 2 and 3, the results thus obtained being multiplied by 1.124. Thus, from fig. 2 it is seen that on November 6, 1906, the logarithm of the pyrheliometer readings for both a. m. and p. m. observations, extrapolated to zero atmosphere, equals 0.2540. To this is to be added 0.0457 to reduce the readings to the Smithsonian actinometric scale, and 0.0079 is to be subtracted to reduce the readings to mean solar distance. Finally adding 0.0508, the logarithm of the factor 1.124, we obtain for the value of the solar constant the number whose logarithm is 0.3426, or 2.201. The values of the solar constant computed by Fowle's formula are generally higher than the values computed by means of equation (20).

[11] Ibid., p., 114.

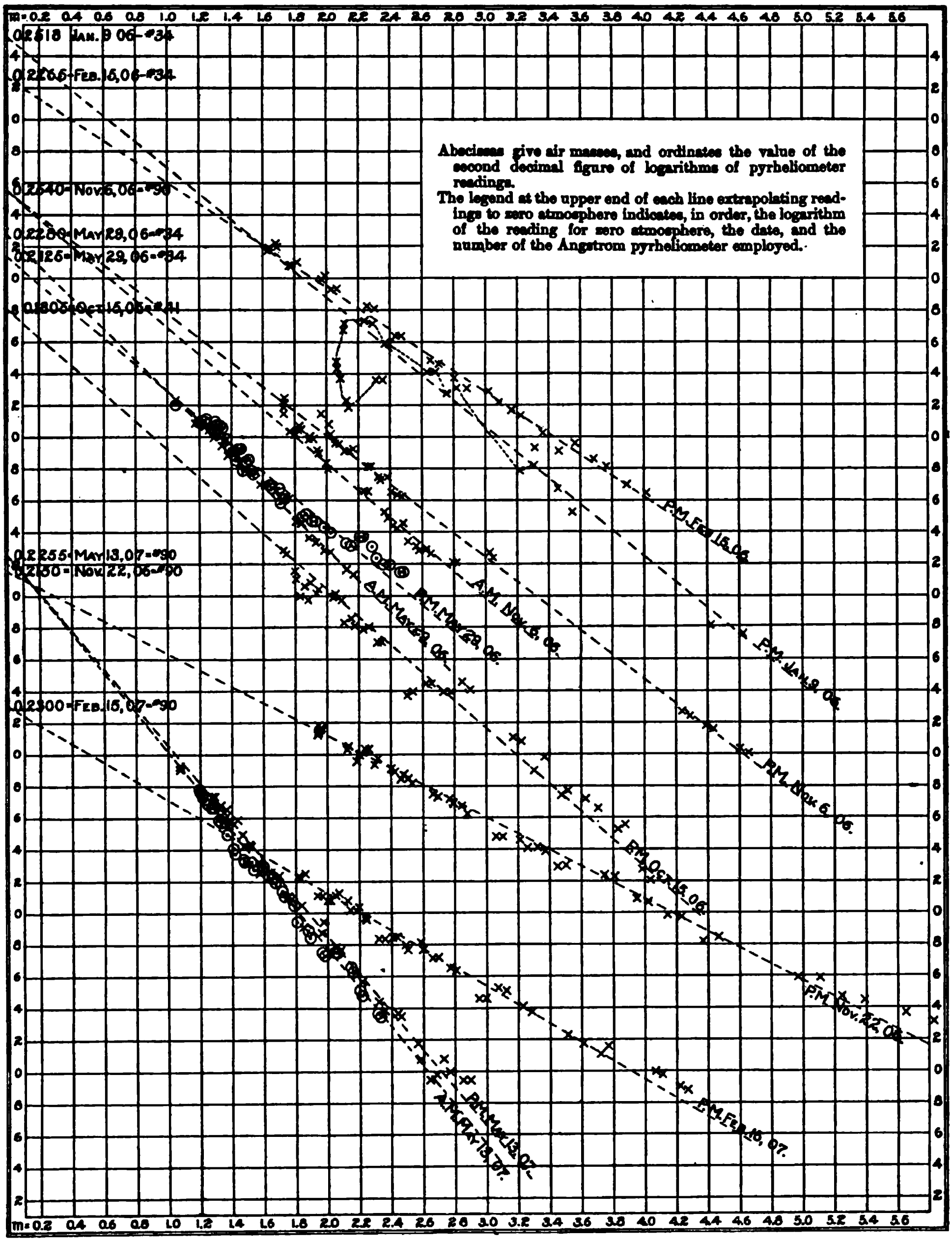

Fig. 2.—Pyrheliometer observations, Washington, D. C.

TABLE 7.—*Comparison of computed values of the solar constant.*

Date.	Bolometric determinations.		Pyrheliometric determinations.
	Mount Wilson.	Astrophysical Observatory.	Weather Bureau.
1906.	*Salar constant.*	*Solar constant.*	*Solar constant.*
January 9	....	2.252	2.249
February 15	....	2.215	2.075
May 29	2.008	2.154	2.000
October 13	1.984		
October 15	....	....	2.006
October 16	2.043		
November 6	....	2.093	2.113
November 22	....	2.046	1.942
1907.			
February 15	....	1.972	2.006
May 13	....	2.119	2.035
Means	....	2.122	2.053

Table 7 gives comparisons between computations made by equation (20) from pyrheliometric observations obtained at the Weather Bureau in Washington, and bolometric determinations made by the Smithsonian Institution at the Astrophysical Observatory in Washington, and on Mount Wilson.[12] These ten days are the only ones on which simultaneous observations were obtained, due to the fact that atmospheric conditions at Washington are unfavorable for pyrheliometric measurements during the summer months.

It will be noted that on May 29, and again in October, 1906, the agreement between the Weather Bureau pyrheliometric and the Mount Wilson bolometric determinations is very close. The agreement with the Washington bolometric determinations is not so good, but in most cases the cause is apparent.

Thus, on February 15, 1906, the pyrheliometric observations at the Astrophysical Observatory[13] extended from air mass 1.678 to 2.836 only, while my own observations, as shown in fig. 2, extended to air mass 4.0. Evidently quite a different result is obtained from the observations as plotted from what would have been obtained if the observations had ceased at air mass 2.8 or 2.9. The ratio $\frac{Q_2}{Q_1}$ is larger, and in consequence δ and Q_0 are smaller. Similarly, on May 29, 1906, at the Astrophysical Observatory observations ceased with air mass 2.197, while at the Weather Bureau observations were extended to air mass 2.480. Figure 2 shows relatively higher readings between air masses 2.20 and 2.48 than were obtained with smaller air masses, and the consideration of these also gave a lower value of the solar constant than would have been obtained if observations had ceased with air mass 2.2. On May 13, 1907, the consideration of both a. m. and

[12] Ibid., p., 97 and 98. [13] Ibid., p. 93, 94.

p. m. observations gave a lower value of the solar constant than would have been obtained from consideration of the p. m. observations alone. The only discrepancy of any considerable amount left unaccounted for is one of 5 per cent on November 22, 1906.

Equation (10) enables us to compute the atmospheric transmission for different wave lengths, provided δ is known. In Table 8 are given the results of such computations, and also comparisons with the transmission coefficients obtained at the Astrophysical Observatory of the Smithsonian Institution[14] by means of bolometric measurements.

TABLE 8.—*Computed atmospheric transmission, and departure from Smithsonian bolometric determinations.*

λ	Feb. 15, 1906.		May 29, 1906.		Nov. 6, 1906.		Nov. 22, 1906.		Feb. 15, 1907.		May 13, 1907.	
	Transmission.	Departure.	Transmission.	Departure.	Transmission.	Departure.	Transmission.	Departure.	Transmission.	Departure.	Transmission-	Departure.
.387	0.552	+.074	0.577	....	0.514	....	0.657	....	0.594	....	0.433	....
0.390	0.570	+.123	0.594	+.310	0.560	....	0.678	+.094	0.611	....	0.454	+.065
0.3942	0.597	+.089	0.621	+.274	0.587	....	0.696	+.147	0.636	—.072	0.482	—.081
0.3987	0.622	+.130	0.644	+.284	0.612	+.030	0.716	+.149	0.660	—.113	0.510	—.034
0.4037	0.643	+.130	0.665	+.182	0.633	—.013	0.734	+.119	0.679	—.039	0.583	—.023
0.4091	0.661	+.119	0.682	+.214	0.652	+.006	0.749	+.076	0.697	—.031	0.555	+.080
0.4147	0.676	+.111	0.696	+.186	0.667	+.078	0.760	+.092	0.710	—.081	0.572	+.050
0.4210	0.690	+.087	0.710	+.129	0.681	+.064	0.772	+.096	0.723	—.062	0.588	+.060
0.4275	0.703	+.086	0.722	+.189	0.694	+.091	0.782	+.068	0.785	—.001	0.603	+.081
0.4343	0.715	+.100	0.734	+.130	0.706	+.117	0.791	+.053	0.746	+.012	0.617	+.108
0.4417	0.727	+.087	0.745	+.128	0.718	+.026	0.801	+.042	0.757	+.011	0.631	+.061
0.4494	0.738	+.110	0.756	+.144	0.730	—.003	0.810	+.055	0.768	+.002	0.645	+.060
0.4578	0.750	+.110	0.767	+.155	0.742	+.044	0.819	+.037	0.778	—.004	0.659	+.052
0.4666	0.760	+.070	0.777	+.143	0.758	+.045	0.827	+.045	0.788	—.030	0.672	+.045
0.4762	0.771	+.058	0.787	+.092	0.764	+.080	0.835	+.031	0.798	—.038	0.685	+.018
0.4861	0.781	+.070	0.796	+.060	0.774	+.081	0.848	+.050	0.807	—.019	0.697	+.024
0.4974	0.790	+.076	0.805	+.064	0.783	+.099	0.850	+.026	0.815	—.022	0.708	+.021
0.5094	0.799	+.088	0.814	+.045	0.793	+.075	0.858	+.036	0.824	—.018	0.720	+.044
0.5226	0.809	+.078	0.823	+.078	0.803	+.101	0.865	+.029	0.832	—.018	0.782	+.061
0.5370	0.818	+.072	0.832	+.098	0.812	+.126	0.872	+.029	0.840	+.008	0.748	+.079
0.5525	0.828	+.064	0.841	+.075	0.821	+.062	0.879	+.018	0.849	+.006	0.755	+.073
0.5697	0.837	+.075	0.849	+.078	0.831	+.058	0.886	+.025	0.857	+.012	0.766	+.076
0.5889	0.846	+.064	0.858	+.069	0.840	+.025	0.893	+.032	0.866	+.003	0.778	+.117
0.6098	0.855	+.050	0.866	+.048	0.849	+.023	0.900	+.029	0.874	—.001	0.789	+.078
0.6333	0.864	+.053	0.875	+.014	0.858	+.015	0.907	+.016	0.882	+.007	0.800	+.048
0.6610	0.873	+.062	0.883	±.000	0.868	—.011	0.913	+.020	0.890	—.026	0.812	+.005
0.6925	0.881	+.036	0.891	—.004	0.877	—.020	0.920	—.018	0.898	—.001	0.828	+.008
0.7280	0.890	+.029	0.900	+.003	0.886	—.014	0.927	—.006	0.906	—.004	0.834	—.004
0 7690	0.899	+.014	0.908	+.019	0.894	—.033	0.933	—.022	0.918	—.012	0.845	—.002
0.818	0.907	+.010	0.915	+.024	0.903	—.030	0.939	—.003	0.921	—.014	0.856	+.007
0.877	0.9[illegible]5	+.009	0.923	+.019	0.911	—.031	0.945	—.006	0.928	—.010	0.867	—.014
0.946	0.9[illegible]	+.005	0.930	+.030	0.919	—.016	0.951	—.006	0.935	—.007	0.876	—.032
1.034	0.93[illegible]	+.007	0.937	+.017	0.927	—.006	0.956	—.012	0.942	—.026	0.886	—.049
1.127	0.936	+.020	0.943	+.001	0.933	+.008	0.961	—.007	0.947	—.010	0.894	—.083
1.239	0.942	+.032	0.948	±.000	0.939	+.023	0.965	—.012	0.952	—.003	0.902	—.036
1.367	0.947	+.031	0.953	±.000	0.944	+.019	0.969	+.003	0.957	+.006	0.909	—.018
1.508	0.952	+.010	0.957	+.017	0.949	+.026	0.972	+.030	0.961	+.006	0.914	±.000
1.648	0.955	+.026	0.960	+.033	0.952	+.004	0.975	+.020	0.964	+.007	0.919	+.080
1.786	0.958	+.046	0.963	+.076	0.955	—.004	0.977	+.018	0.966	+.018	0.922	+.058
1.924	0.960	+.048	0.965	+.051	0.957	+.004	0.978	—.006	0.968	+.066	0.925	+.028
2.060	0.961	+.090	0.966	+.028	0.959	—.003	0.979	+.067	0.969	+.040	0.927	+.082
2.196	0.962	+.095	0.967	+.032	0.960	+.022	0.980	+.062	0.970	+.037	0.928	+.018
2.316	0.962	+.099	0.968	+.039	0.960	+.022	0.980	+.097	0.970	+.045	0.929	+.149
2.428	0.963	+.183	0.968	+.033	0.960	+.012	0.980	+.062	0.971	+.063	0.929	+.488

On November 6, 1906, and February 15, 1907, the agreement is very good in all parts of the spectrum. On February 15, May 29, and No-

[14] Ibid., p. 113.

vember 22, 1906, and May 13, 1907, the computed coefficients are generally higher than the coefficients determined from bolometric measurements. This is particularly the case on February 15 and May 29, 1906, as we would expect from the comparisons in Table 7.

Table 9 shows the relative excess of atmospheric absorption determined by bolometric measurements as compared with the absorption computed by equation (10), after applying a correction for the differences between the curves c, c and c', c', fig. 1. As already stated, the absorption is the complement of the transmission. The determinations by bolometric observations do not show marked abnormal absorption on any date, altho on November 22, 1906, it was relatively greater for wave lengths less than 0.66 μ than it was for longer wave lengths, while the reverse was true on February 15, 1907.

TABLE 9.—*Departure of atmospheric absorption computed from pyrheliometric observations at the Weather Bureau as compared with that determined by bolometric observations at the Smithsonian Institution.*

λ	Per cent.					
	February 15, 1906.	May 29, 1906.	November 6, 1906.	November 22, 1906.	February 15, 1907.	May 15. 1907.
0.387	−14	....	....	....	....	....
0.390	−25	−43	....	−20	....	− 9
0.3942	−22	−45	....	−36	+19	+ 3
0.3987	−31	−48	−13	−40	− 5	+ 2
0.4037	−31	−58	− 2	−36	+ 7	+ 1
0.4091	−28	−42	− 4	−26	+ 8	− 8
0.4147	−26	−39	−20	−29	+11	−11
0.4210	−22	−31	−16	−29	+29	−12
0.4275	−20	−31	−21	−20	+ 4	−15
0.4348	−24	−31	−27	−18	− 2	−20
0.4417	−24	−33	− 8	−17	− 4	−14
0.4494	−31	−36	+ 3	−20	+ 2	−13
0.4578	−27	−37	−11	−11	+10	−10
0.4666	−21	−37	−13	−18	+20	−10
0.4762	−15	−27	−22	−10	+30	− 2
0.4861	−21	−20	−24	−20	+16	− 5
0.4974	−24	−22	−29	−11	+17	− 5
0.5094	−27	−15	−23	− 8	+14	−10
0.5226	−22	−25	−29	− 9	+18	−14
0.5370	−21	−30	−34	− 7	+ 6	−18
0.5525	−21	−26	−20	− 2	+ 6	−18
0.5697	−23	−25	−16	− 3	+ 6	−18
0.5889	−17	−20	+ 1	− 4	+18	−27
0.6098	−15	−15	− 1	− 6	+18	−20
0.6383	−23	− 4	− 4	− 6	+ 2	−14
0.6610	−34	− 3	+ 7	−21	+27	− 4
0.6925	−31	− 8	+ 8	+10	−11	− 8
0.7280	−32	−18	− 2	−15	−18	− 7
0.7690	−25	−31	+25	+16	− 4	− 8
0.818	−24	−36	+22	−21	− 2	−15
0.877	−27	−36	+26	−20	−10	− 2
0.946	−26	−46	± 0	−23	−16	+17
1.084	−35	−46	−21	−25	+19	+45
1.127	−45	−33	−35	−34	−19	+233
1.239	−48	−25	−43	− 4	−22	+37
1.367	−46	−17	−36	−32	−29	+14
1.508	−33	−43	−45	−78	−33	−10
1.648	−56	−64	−35	−75	−49	−40
1.786	−57	−71	± 0	−54	−42	−44
1.924	−44	−49	+11	+90	−92	−18
2.060	−52	− 8	+68	−50	−24	− 9
2.196	−57	−20	− 5	−52	−27	+ 1
2.316	−47	− 6	+21	−53	−13	−52
2.428	−46	−32	+81	−10	−10	−78

It is not to be supposed that the differences shown in Tables 8 and 9 are all to be attributed to errors of observation or computation. The Weather Bureau pyrheliometer is about 85 feet higher than the Smithsonian bolometer, and is on the outskirts of the city, where the atmosphere contains relatively little smoke, particularly with a northwest wind. On November 6 and 7, 1906, the ratio between Smithsonian and Weather Bureau actinometer readings was 1.06, and on November 22, 1906, it was 1.10, while comparisons with both instruments at the same place shows that the ratio is about 1.11.

TABLE 10.—*Mount Weather pyrheliometer readings reduced to the scale of Angström No. 104.*

Date.	Air mass.								
	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
1907.									
September 21, a. m.	....	....	....	0.696	0.788	0.894	1.014	1.151	....
September 24, a. m.	....	....	0.715	0.799	0.892	0.997	1.114	1.245	....
September 25, a. m.	....	....	0.801	0.879	0.964	1.058	1.161	1.275	....
October 9, a. m.	....	....	....	....	1.123	1.201	1.284	1.374	....
1908.									
January 2, a. m.	....	....	0.940	1.024	1.117	1.218	1.328	....	....
January 5, a. m.	....	....	....	1.000	1.086	1.178	1.278	....	....
January 5, p. m.	....	....	0.874	0.941	1.001	1.097	1.188	....	....
January 6, p. m.	....	0.871	0.938	1.001	1.088	1.177	1.276	....	....
January 9, a. m.	....	....	....	....	0.994	1.089	1.193	....	....
January 14, p. m.	0.776	0.846	0.916	0.993	1.077	1.168	1.267	....	....
January 15, a. m.	....	....	....	....	1.090	1.178	1.275	....	....
January 17, a. m.	0.801	0.859	0.928	0.993	1.066	1.145	1.248	....	....
January 17, p. m.	0.775	0.837	0.903	0.978	1.050	1.182	1.230	....	....
January 19, a. m. and p. m.	....	....	....	....	1.052	1.139	1.233	....	....
January 22, a. m.	....	....	0.911	0.997	1.093	1.197	1.312	....	....
January 22, p. m.	0.776	0.821	0.867	0.926	1.009	1.100	1.199	....	....
January 30, a. m.	....	....	1.030	1.084	1.138	1.195	1.258	....	....
February 6, p. m	....	....	....	0.865	0.956	1.060	1.176	1.304	....
February 8, a. m.	....	....	....	....	1.026	1.125	1.232	1.350	....
February 8, p. m	0.737	0.777	0.813	0.888	1.008	1.107	1.218	....	....
February 28, p. m	....	....	....	0.797	0.855	0.949	1.047	1.228	....
February 29, a m.	....	....	....	....	....	....	1.090	1.220	....
March 10, p. m.	0.534	0.588	0.647	0.712	0.783	0.885	1.008	1.149	....
March 11, a. m	0.793	0.848	0.907	0.971	1.039	1.115	1.192	1.275	....
March 12, a. m.	....	....	....	....	....	....	....	1.075	....
April 12, p. m	....	....	....	0.726	0.828	0.946	1.079	1.232	1.404
April 13, a. m	....	0.791	0.855	0.925	0.999	1.080	1.168	1.262	1.365
April 16, p. m.	....	....	0.803	0.862	0.915	1.012	1.119	1.238	1.369
April 29, a. m.	....	....	....	....	0.800	0.904	1.016	1.144	1.288
May 1, a. m	....	....	....	....	0.906	0.971	1.048	1.119	1.201
May 2, a. m	....	....	....	1.063	1.078	1.092	1.107	1.123	1.138
May 26, a. m.	....	....	0.752	0.816	0.883	0.958	1.038	1.127	1.222
May 27, a. m	....	....	....	....	....	....	....	....	1.184
June 2, a. m.	....	....	....	....	0.949	1.031	1.119	1.230	1.367
June 3, a. m.	....	....	....	....	....	....	....	....	1.151
June 12, p. m	....	....	....	....	0.612	0.666	0.770	1.020	1.181
June 16, a. m.	....	....	....	0.799	0.884	0.977	1.081	1.223	1.380
June 16, p. m	....	....	....	0.897	0.976	1.063	1.158	1.262	1.374
June 24, a. m.	....	....	....	....	....	....	....	1.079	1.241
June 27, a. m.	....	....	....	0.746	0.811	0.881	0.968	1.041	....

In Tables 10 and 11 are given the pyrheliometer readings, corresponding to certain air masses, that have been obtained at Mount Weather since the installation of the apparatus in September, 1907. Equations (15) to (20) require a slight modification to adapt them to

the elevation of Mount Weather, which is about 1,725 feet. Again following Abbot[15] we obtain, for the quantity of aqueous vapor above this level, $E_{\omega} = 2.18\, e_{\omega}$, where e_{ω} = the vapor tension as observed at the mountain station. Tables corresponding to those of which 4 and 5 are sections have been compiled from equations (19) and (20), substituting therein E_{ω} in place of E_{0}.

TABLE 11.—*Mount Weather pyrheliometer readings reduced to the Smithsonian actinometric standard and to mean solar distance.*

Date.	Air mass.								
	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
1907.									
September 21, a. m				0.778	0.882	1.000	1.184	1.287	
September 24, a. m			0.798	0.892	0.996	1.114	1.243	1.390	
September 25, a. m			0.894	0.981	1.076	1.181	1.296	1.428	
October 9, a. m.					1.246	1.331	1.428	1.522	
1908.									
January 2, a. m			0.831	0.902	0.975	1.057	1.144		
January 5, a. m				1.099	1.198	1.307	1.425		
January 5, p. m			0.988	1.073	1.165	1.264	1.372		
January 6, p. m		0.871	0.938	1.010	1.088	1.177	1.276		
January 9, a. m					1.068	1.170	1.281		
January 14, p. m	0.834	0.909	0.985	1.068	1.158	1.256	1.362		
January 15, a. m					1.170	1.265	1.369		
January 17, a. m	0.860	0.923	0.991	1.066	1.144	1.229	1.335		
January 17, p. m	0.832	0.899	0.970	1.046	1.128	1.217	1.322		
January 19, a. m. and p. m					1.130	1.224	1.325		
January 22, a. m			0.979	1.072	1.175	1.286	1.411		
January 22, p. m	0.835	0.882	0.932	0.995	1.084	1.182	1.289		
January 30, a. m			1.110	1.167	1.225	1.287	1.356		
February 6, p. m				0.932	1.088	1.145	1.270	1.409	
February 8, a. m					1.110	1.211	1.332	1.462	
February 8, p. m	0.796	0.840	0.898	0.960	1.090	1.197	1.317		
February 28, p. m				0.869	0.932	1.035	1.142	1.339	
February 29, a. m							1.189	1.330	
March 10, p. m	0.585	0.644	0.708	0.780	0.858	0.970	1.105	1.258	
March 11, a. m	0.869	0.930	0.995	1.065	1.140	1.222	1.307	1.398	
March 12, a. m								1.180	
April 12, p. m				0.810	0.925	1.055	1.205	1.375	1.568
April 13, a. m		0.883	0.955	1.033	1.116	1.206	1.305	1.410	1.524
April 16, p. m			0.899	0.965	1.025	1.138	1.282	1.386	1.532
April 29, a. m					0.902	1.017	1.145	1.290	1.452
May 1, a. m					1.022	1.096	1.177	1.268	1.355
May 2, a. m				1.201	1.218	1.234	1.251	1.269	1.286
May 26, a. m			0.857	0.930	1.007	1.092	1.184	1.285	1.393
May 27, a. m									1.351
June 2, a. m					1.085	1.178	1.279	1.406	1.562
June 3, a. m.									1.317
June 12, p. m					0.701	0.763	0.882	1.168	1.353
June 16, a. m.				0.916	1.014	1.121	1.240	1.402	1.582
June 16, p. m				1.029	1.120	1.220	1.328	1.447	1.576
June 24, a. m.								1.289	1.425
June 27, a. m.				0.856	0.931	1.012	1.111	1.195	

In Table 12 are given the results of solar constant computations, from the data given in Table 11, by the use of these modified tables. The mean value, 2.027, is in very close agreement with that obtained from Washington observations. Here also the value computed by equation (20) is considerably lower than that computed by Fowle's formula, as shown in column 6. The highest value is 2.255, and the

[15] Ibid., p., 129.

lowest value is 1.854, but in the majority of cases the departure from the mean value does not exceed 3 per cent. In Table 13 are collected the results for those days on which a value of the solar constant was computed from observations at both Washington and Mount Weather. Since the results on individual days are in some cases discordant, I have plotted many of the observations in detail on fig. 3, in order that these discrepancies may be studied.

TABLE 12.—*Solar constant computations from Mount Weather observations.*

Date.	Q_3/Q_2	e_ω	δ	Q_0 (W. B.)	Q_0 (Fowle.)	Relative weight.	Quadrant.		Wind.	
							High area.	Low area.	Dir.	Vel.
1907.										
September 21, a. m..	0.777	15.65	0.510	1.893	2.113	6	....	20	w.	15
September 24, a. m..	0.801	11.36	0.525	2.011	2.181	7	......	13	sw.	13
September 25, a. m..	0.830	5.87	0.535	2.001	2.112	8	15	20	nw.	25
October 9, a. m.....	0.877	5.16	0.275	1.979	2.090	4	1	....	nw.	6
1908.										
January 5, a. m.....	0.841	2.62	0.575	2.182	2.267	4	7	....	s.	40
January 5, p. m.....	0.849	2.36	0.535	2.069	2.141	8	7	....	nw.	20
January 6, p. m.....	0.853	2.69	0.490	1.898	2.039	5	4	....	se.	10
January 9, a. m.....	0.834	1.65	0.675	2.014	2.074	2	....	20	nw.	30
January 14, p. m....	0.851	2.03	0.535	2.051	2.117	2	16	....	nw.	35
January 15, a. m...	0.855	2.59	0.485	2.031	2.097	8	8	....	se.	15
January 17, a. m....	0.857	2.62	0.470	1.972	2.035	5	3	....	se.	5
January 17, p. m....	0.854	2.62	0.490	1.967	2.055	5	4	....	se.	15
January 19, a. m. and p. m.	0.853	2.79	0.490	1.975	2.051	4	2	....	nw.	25
January 22, a. m....	0.883	4.78	0.550	2.184	2.287	2	15	....	nw.	20
January 22, p. m....	0.841	3.81	0.535	1.968	2.042	3	7	....	nw.	30
February 6, p. m ...	0.813	3.56	0.755	2.079	2.157	3	....	5	nw.	25
February 8, a. m ...	0.833	1.32	0.710	2.111	2.158	6	6	....	nw.	25
February 8, p. m ...	0.828	1.45	0.740	2.111	2.158	2	5	....	nw.	20
March 10, p. m.....	0.777	3.30	1.070	2.255	2.089	2	2	....	nw.	16
March 11, a. m......	0.872	3.33	0.355	1.854	1.928	4	2	....	sw.	7
April 12, p. m.......	0.768	4.98	1.045	2.183	2.292	4	2	....	nw.	20
April 13, a. m.......	0.855	4.60	0.415	1.919	2.001	4	8	....	nw.	28
April 16, p. m	0.818	3.33	0.730	2.078	2.105	1	6	....	ne.	10
June 2, a. m........	0.819	8.64	0.505	2.008	2.167	3	6	....	nw.	11
June 16, a. m.......	0.818	9.04	0.500	1.946	2.090	3	6	....	nw.	24
June 16, p. m.......	0.843	8.84	0.360	1.968	2.100	8	6	....	nw.	10
Means..........	....	....	....	2.027	2.113	....	....	....		

TABLE 13.—*Comparison between values of the solar constant computed from Washington and Mount Weather observations.*

Date.	Washington.	Mount Weather.	Date.	Washington.	Mount Weather.
1907.			1908.		
October 9, a. m ...	1.945	1.979	February 8, p. m.	2.102	2.111
October 9, p. m ...	2.043	....	April 16, p. m....	2.031	2.078
1908.			June 2, a. m.....	2.028	2.008
January 9, a. m...	....	2.014	June 16, a. m....	....	1.946
January 9, p. m...	1.843	....	June 16, p. m....	1.948	1.968
January 14, p. m..	2.018	2.051			
February 6, p. m..	1.970	2.079	Means........	1.992	2.034
February 8, a. m..	....	2.111			

January 9, 1908. The Mount Weather observations plotted on fig. 3 show that the atmospheric transmission increased thruout the day, and the Washington observations indicate that it increased during the

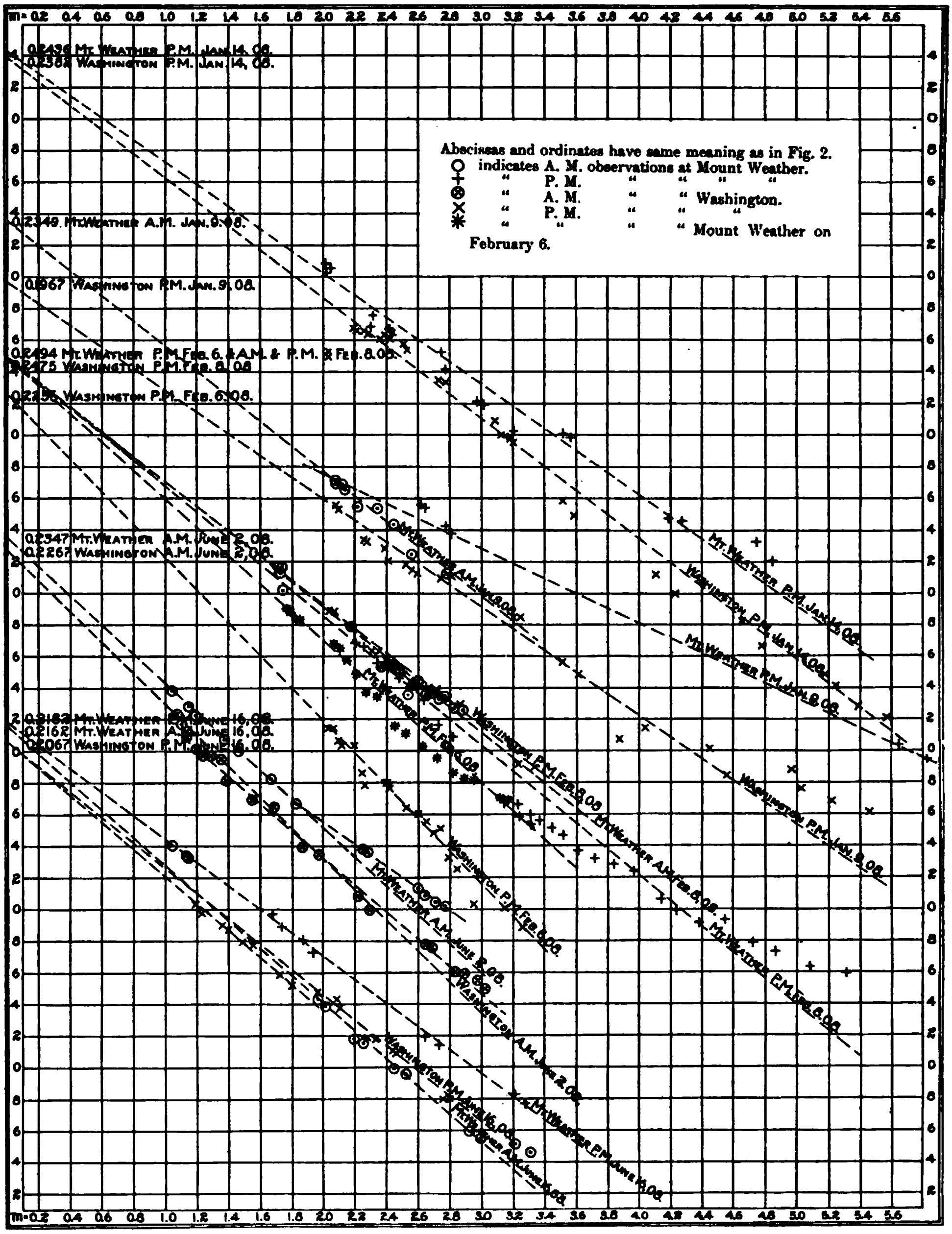

Fig. 3.—Pyrheliometer observations, Washington, D. C., and Mount Weather, Va.

afternoon. This would tend to make the value of the solar constant computed from a. m. observations at Mount Weather too high, and that computed from p. m. Washington observations too low.

February 6, 1908. Conditions at both stations were unsteady, and observations were discontinued at an early hour on account of the approach of cirrus clouds.

June 2 and 16, 1908. On neither of these dates do the observations indicate steady conditions, except at Mount Weather on the afternoon of June 16. At Washington on June 16 apparently a clearing of the atmosphere occurred at air mass 1.9, with reasonably steady atmospheric conditions preceding and following, as indicated by the fact that the observations taken before and after this time both extrapolate to the same value for zero air mass. On June 2 apparently the atmospheric transmissibility diminished at both stations to about air mass 1.8, and was quite constant after that time.

If, however, we disregard the results on January 9 and February 6, the agreement between the two stations is very close, and especially so on February 8, when the sky was unusually clear at both stations.

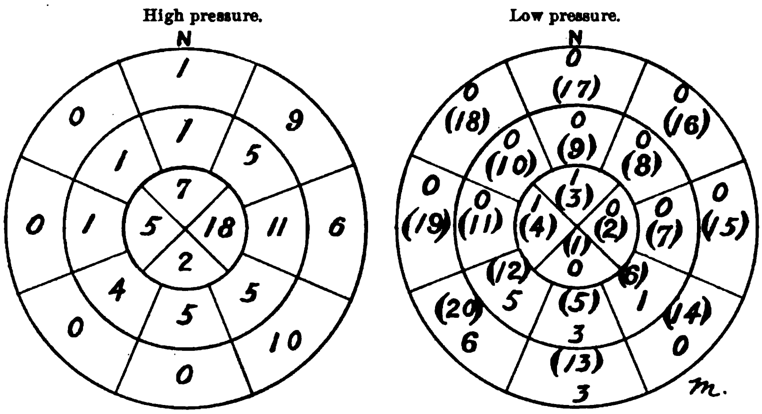

FIG. 4.—Number of times observations were obtained at Washington, D. C., in the different sections of high and low pressure areas.

It seems fair to assume that most of the irregularities shown in column 5 of Tables 6 and 12 are due to variations in the atmospheric transmissibility during the periods of observation. In column 7 of these tables I have indicated the relative weight that the appearance of the plotted observations indicates should be given to the value of the solar constant computed from them. A weight of ten is given to observations extending thru both the morning and the afternoon of the same day that plot on practically the same line, as was the case

on May 13, 1907. In the following columns is shown by numbers the section of the high or low pressure area in which the observations were obtained, the sections corresponding to these numbers being indicated by the figures in parentheses on the diagram of the low pressure area in fig. 4. It is apparent that most of the observations are obtained to the southeast of a center of high pressure, or to the south of a center of low pressure, where the wind is from the northwest. In fact, at Washington, out of the 69 different occasions on which observations were obtained from which the solar constant was computed, the wind was from some point between northwest and northeast on all but 15 of them. The mean of the 15 values of the solar constant computed from observations with the wind from some point between southeast and southwest is 1.950, or 3 per cent below the mean, and May 13, 1907, is the only day on which really good observations were obtained with the wind from a southerly direction.

In the Washington observations the value of δ has ranged from 0.255 to 1.960, and the value of e_0 from 0.91 to 13.61. At Mount Weather the value of δ has ranged from 0.275 to 1.070, and the value of e_ω from 1.32 to 15.65. Equation (20) therefore appears to enable us to compute the value of the solar constant with a degree of accuracy comparable with that attainable with any apparatus at sea level, where the atmospheric conditions are too variable for highly accurate determinations.

The simplicity of the process should lead to its very general use in the reduction of pyrheliometric readings, and from the very many observations now being made in all parts of the world it should be easy to detect variations in the solar constant of 3 per cent or more if they occur.

The absolute value of the solar constant is dependent on the accuracy of the pyrheliometric scale employed. Unfortunately different types of pyrheliometers are not in accord; but by means of the data given in Table 6, Comparison of pyrheliometers, it is believed that the relation between the Smithsonian actinometric standard and Ångström's pyrheliometric scale has been established. Comparisons between the Ångström and other types of instruments should now make it possible to establish the relations between all of the more important types of pyrheliometers in use, and thus make comparable the results obtained in all parts of the world. The need of an international pyrheliometric standard is, however, apparent.

The constants to equation (10) may be slightly in error. They were computed, as stated, from Abbot's values of atmospheric transmission,

as given. When plotted as in fig. 1, *b*, *b*, a depression is noted in the curve between wave lengths .50 μ and .68 μ. This is due to the fact that the effects of atmospheric band absorption have not been entirely eliminated. Slightly more accurate results would probably be obtained by computing the constants of equation (10) from values of atmospheric transmission read off from the smooth curve *b*, *b*. This would necessitate a redetermination of the constants of equations (13) and (14), which is also desirable from other considerations.

It may also be that the correction applied for ultraviolet radiation is too small. This would affect the absolute value of the solar constant and modify somewhat the values of x_λ, especially in the violet end of the spectrum, but would have little effect upon the relative values of the solar constant computed from day to day.

There may at times be a small percentage of error in the computed value of the solar constant on account of abnormal absorption, particularly in the violet end of the spectrum. This may have been the case on November 22, 1906. The absorption cell suggested by Ångström[16] should enable us to detect this, and such a cell has been in use both in Washington and at Mount Weather during the past year, but not with very satisfactory results. The transmission coefficients of the cell as determined by the U. S. Weather Bureau of Standards, are as follows:

TABLE 14.—*Transmission coefficients of absorption cell.*

Wave length.	Transmission.	Wave length.	Transmission.
μ	*Per cent*	μ	*Per cent.*
0.350	1	0.450	30
0.360	4	0.460	24
0.370	11	0.470	18
0.380	19	0.480	11
0.390	28	0.490	6
0.400	30	0.500	3
0.410	30	0.510	1
0.420	31	0.565	Less than 0.01
0.430	31	0.706	0.02
0.440	31		

From .700 μ to 9.000 μ in the infra-red and beyond 0.345 μ in the ultraviolet the transmission is zero. These transmission factors when plotted on fig. 1 as ordinates, with x_λ as abscissas, give the curve shown in the lower left-hand of the figure, which agrees in form with the transmission curve determined by Ångström, altho the factors are about one-third smaller.

In a paper which is to follow the relations between atmospheric transmission and the polarization of sky light will be discust.

[16] Nova Acta Regiæ Societatis Scientiarum Upsaliensis. Ser. IV. Vol. 1, No. 7, p. 8.

RECENT AURORAL DISPLAYS AND MAGNETIC DISTURBANCES.

By W. R. Gregg.

Within the past few months two auroras have been observed at Mount Weather, Va., and it is believed that a brief account of these may be of general interest, inasmuch as both were accompanied by violent magnetic perturbations. The first appearance occurred during the evening of March 26. At about 6:45 p. m. the magnets which are used to indicate variations in the three magnetic elements were found to be in a state of considerable agitation. Shortly thereafter there was observed on the northern horizon a rather indistinct and ill-defined illumination, having the appearance of a phosphorescent glow, and entirely lacking any well-marked bands, rays, or arcs, such as usually characterize the polar aurora. This illumination extended upward from the horizon about 10° or 12° and was very steady in intensity and extent until 8 p. m., after which it gradually disappeared.

As before stated, during the appearance of the phenomenon a violent magnetic disturbance was in progress. This storm began at noon of the same day, and its commencement was exceedingly abrupt, conditions having been unusually quiet for nearly a week previous. The fluctuations in the positions of the magnets were very large, the photographic sheets upon which the elements are continuously recorded showing frequent changes in the declination of from ten to fifty minutes of arc within a few minutes of time, and similarly large and abrupt changes in both the horizontal and the vertical intensities. At 3 a. m. of the following morning, March 27, conditions became comparatively calm, altho there continued to be a slight shivering or oscillatory movement of the magnets until noon, after which there occurred a repetition of the conditions which had prevailed on the preceding day. At 3:30 p. m. the magnet which records variations in the vertical intensity was completely unbalanced, so violent were the fluctuations which characterized the storm. These fluctuations continued until about 3 a. m., March 28, after which there was a marked decrease, altho conditions did not return to their normal state until about noon of the 31st.

On the evening of March 27 and practically coincident with the largest fluctuations of the magnets a fairly bright and characteristic-

ally marked aurora was observed in the northern and eastern portions of the United States, notably in Harrisburg, Pa., and in New York, N. Y. In this connection a portion of a letter, dated March 30, 1908, from Mr. C. H. Eshleman, at that time Assistant Observer at Harrisburg, Pa., will be of interest. He says in part:

A very unusual phenomenon was observed in different parts of this county Friday night, March 27, between 8 and 8:30 p. m. It consisted of an extremely fleecy, whitish band or stream a little north of the zenith extending east and west. There was a slight curvature, the convex side being toward the zenith. The ends extended very far east and west, but did not touch the horizon. The whole thing had a rapid westward movement and along the side of it, touching it and extending for a distance of about 5° to the northward, small streamers moved much faster than the main stream. Sometimes only a few were visible; at other times a dozen or more. The distances between them were not uniform, but they did not change. They did not flash and were slightly lighter in color than the main stream. At about 8:30 p. m. the whole thing moved to the westward and disappeared. When last visible it had curved more to the northwest and looked like a comet's tail. All who witnessed the phenomenon agree as to the unusual whitish appearance and the westward movement.

Clippings from various newspapers give accounts essentially the same as the foregoing, all agreeing in the following particulars: (1) The main portion of the phenomenon had the form of an arch; (2) streamers from it were continually forming and were moving more rapidly than the main stream; (3) the movement of the main stream and its attendant streamers, as a whole, was from the east toward the west.

As is well known the polar aurora frequently presents the most varied and complex forms, especially in temperate latitudes. It is seldom, therefore, that we see a perfect type, just as we seldom see a typical cirrus or cumulus cloud. Almost invariably one form merges into another, and we see merely the complex result. In the one here under discussion the arched form and the rapidly moving streamers stamp the phenomenon as unquestionably a display of the aurora borealis. The supposition that it may have been the zodiacal light can not be taken seriously, when we recall that the latter always appears as a steady glow and has a triangular form. The fact that the movement was from the east toward the west is of especial interest, inasmuch as auroras are much more frequently observed to travel in the opposite direction. It was indeed largely for this reason that the various cosmic hypotheses advanced during the seventeenth and eighteenth centuries could not be accepted, for, if the aurora were produced by causes external to the earth, it would necessarily present an apparent movement from east to west, like other celestial bodies. However, altho the westward movement is unusual, it is by no means unprece-

dented; a long series of observations at Bossekop, for instance, shows that a small proportion of the auroras observed at that place did have the westward movement.[1]

The most significant fact in connection with the remarkable illumination of March 27, and with the lesser one observed at Mount Weather on March 26, is that a magnetic disturbance of unusual severity, as before stated, was occurring at the same time. Magnetic traces for these dates have been received from Honolulu, H. I., and from Potsdam, Germany, and these show similarly large fluctuations. It is well known that displays of the aurora in temperate latitudes are usually, if not invariably, accompanied by magnetic perturbations, which cover a wide extent, often including both hemispheres. This display seems to have been unusually extensive, reports from Alaska and Canada,[2] and from Europe,[3] indicating that it was general thruout the Northern Hemisphere. It is probable that displays occurred also in the Southern Hemisphere, altho as yet no accounts have been received to verify this statement.

The second appearance of the aurora at Mount Weather, Va., was observed at 11 p. m., May 25. When first seen it was fairly bright, but gradually faded away, and by 11:15 p. m. had entirely disappeared. The only part visible consisted of a narrow luminous band about 3° in breadth and 7° or 8° in length; it was situated due northwest from the station, the lower end being at an elevation of about 15° above the horizon. The light was whitish and there was practically no motion. On the following morning the magnet which is used to indicate variations in vertical intensity was found to be unbalanced, as during the storm of March 26 and 27. When the photographic sheets were developt, it was seen that a magnetic storm of considerable severity had occurred and that the changes in declination and horizontal intensity were most marked just preceding and during the appearance of the aurora. The disturbance did not differ essentially from others, except in the briefness of its duration. It began at 8:15 p. m. of the 25th and ended at 6 a. m. of the 26th; the most violent fluctuations occurred between 9 and 10 p. m. It is quite possible, therefore, that the aurora occurred earlier in the evening and was not observed. It was seen also by the Weather Bureau observer at Richmond, Va., but thus far other accounts of its having been observed have not been received.

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[1] Alfred Angot. Les Aurores Polaires.

[2] Monthly Weather Review, March, 1908, p. 76.

[3] Meteorologische Zeitschrift, July, 1908, p. 314.

Ever since 1741, when Hjorter first noticed that auroras in temperate latitudes are invariably accompanied by temporary disturbances in the magnetic elements, the subject of their connection has been extensively studied and numerous theories have been advanced, yet, until within the past ten or fifteen years at least, none of these theories has been found adequate to account for all the varied forms and structures which the aurora assumes. It would be a waste of time, therefore, to consider the older theories, which have been fully disproved, but it is believed that a brief review of the more recent work along this line may be of interest. In discussing this subject, attention will be given only to those auroras of wide extent, which are always accompanied by magnetic perturbations. The auroras which are seen in the polar regions at low altitudes, which are purely local in extent, and which have no effect upon the magnetic needle constitute an entirely different phenomenon and are probably due to an entirely different cause.

Recent studies with the spectroscope have demonstrated that the light of the aurora is similar to that produced by the bombardment of cathode rays or negative electrons. Birkeland was the first to suggest this as a possible explanation; in 1896 he advanced the theory that clouds of electrons leave the sun at times of disturbance in its electrical condition, and that those which pass near the earth are drawn in by the earth's magnetic field and excite the outer atmosphere to luminescence. He was, however, unable to account by means of this hypothesis for all the varied forms of the aurora, and in 1900 suggested that part of the cathode rays might set up electric currents in the atmosphere, which in turn would send out other cathode rays. In 1906 M. Carl Störmer[4] made a thoro study of Birkeland's original theory and worked out mathematically the trajectories of cathode rays projected into a magnetic field similar to that of the earth. He reached the conclusion that slight differences in the original velocity and direction of these cathode rays produce so great a variation in the paths which they follow, that Birkeland's first theory was sufficient to account for all observed pheonomena. During the same year M. P. Villard,[5] working independently, conducted a series of experiments with an evacuated bulb, in which electrodes were sealed, the negative electrode being arranged so as to project a small bundle of cathode rays into the field of a magnet. Photographs were obtained, and these showed that the effects produced were identical with those seen

[4] Archives des Sciences Phys. et Nat., July–Oct., 1907. Comptes Rendus, 25 Juin, 9 Juillet, 10 Septembre et 1 Octobre, 1906.

[5] Annales de Chimie et de Physique, Septembre, 1906.

in the aurora. The work of Villard, therefore, supplements that of Störmer, the one being experimental, the other mathematical.

They differ, however, in regard to the source of the electrons, the motion of which in the earth's magnetic field produces the aurora. Störmer believes that a cloud of electrons leaves the sun at the time of a sun-spot, whereas Villard contends that they are terrestrial, originating in a cloud under the influence of the sun's radiation. Dr. C. Chree[6] has shown that sun-spots and auroras are not strikingly coincident, so it would seem that Störmer's theory is not sufficient to account for all of the auroras. According to Villard's opinion they must always occur in both hemispheres simultaneously. Unfortunately data are not as plentiful as could be wished; nevertheless, those which have been collected invariably show, so far as known, that northern auroras are accompanied by similar displays in the Southern Hemisphere.

There are other difficulties to be overcome. For instance, Prof. Cleveland Abbe, in a paper on the altitude of the aurora,[7] has shown that auroras occur at heights such that the air pressure varies from one to one-fourth atmosphere, conditions not at all comparable with those obtained in an evacuated bulb used by Villard, or with the theoretical case taken by Störmer, in which the path of the electron is entirely unobstructed. These, together with other objections, can be met only by additional work and more and better data. All in all they are the most satisfactory hypotheses thus far advanced. It may be that both are correct: that auroras are due to the motion of electrons in the earth's magnetic field, and that the source of these electrons is partly solar, partly terrestrial.

[6] Philosophical Magazine, January, 1907.

[7] Terrestrial Magnetism and Atmospheric Electricity, March, June, and December, 1898.

MAGNETIC DECLINATION.

By Eric R. Miller, Research Observer, and W. R. Gregg, Assistant Observer.

The following tables of the hourly values of the magnetic declination from November 19, 1907, to June 30, 1908, were obtained from the records of the magnetographs in the Magnetic Observatory of the Weather Bureau at Mount Weather, Va.

The geographical coordinates of the Absolute House at Mount Weather are:

$$\lambda = 77° \; 53' \; 06''$$
$$\varphi = 39° \; 03' \; 53''$$
$$H = 518 \text{ meters.}$$

The absolute observations of Table 1 were made with a large observatory Wild-Edelmann declinometer and a Wild-Edelmann theodolite with 30 centimeter circles.

No absolute observations of declination were made during the months of November and December. The base line of the declination magnetograph remained unchanged during this time, and the hourly readings are reduced by using the constant difference, 2.5′, for the Eschenhagen magnetograph that obtained after January 1.

The hourly values were obtained from the photographic traces of an Eschenhagen declination magnetograph, supplemented when necessary by readings from the Wild-Edelmann declination magnetograph. The scale and torsion coefficients of these instruments are:

	Scale coefficient.	Torsion coefficient.
Eschenhagen......................	1 mm. = 0.9999′	1.00228
Wild-Edelmann....................	1 mm. = 1.0011′	1.00024

The hourly values of the declination are given in Table 2 in degrees and minutes measured from the north toward the west. The degrees, which are the same, are given once for each month at the upper right-hand corner of the table. The daily mean is the mean of the 24 hourly readings. The maxima and minima are the extremes of the curve, so that the range is not always a true measure of the diurnal variation.

Seventy-fifth meridian time is used thruout. Interpolated values are given where their uncertainty is not greater than 0.3′ and are inclosed in brackets, [ ].

In order to give an impression of the more or less disturbed nature of the daily variations of the declination, there is given under the

heading "Character" a classification of the half-day curves in accordance with the scale devised by the late Doctor Eschenhagen of the Potsdam Magnetic Observatory. This scale is as follows:

1. Very quiet curves, which show exceedingly small sinuosities, very greatly separated.

2. Curves with fairly quiet course; the daily fluctuation is not obscured by somewhat more frequent little waves.

3. Slightly disturbed curves, on which occur secondary waves of moderate amplitude and short period (1 to 3 hours); still the daily march is clearly discernible.

4. More disturbed curves, whose daily marches are much broken up by secondary waves of greater amplitude and longer period (6 to 8 hours).

5. Curves with very large pointed waves and notches which occur in greater number and of longer duration and completely obscure the normal course of the curve.

When the degree of storminess is of character 3 to 5, the hourly values occurring in the disturbed period are marked with the sign $\wr$ beside the reading, so that the monthly table shows at a glance the duration and approximate strength of each disturbance.

Illustrations of the magnetic character numbers are given on figs. 1, 2, and 3.

TABLE 1.—*Summary of absolute observations, Mount Weather, Va.*

Declination.

Date.	Time.	Collimator.	Azimuth of collimator.	North point.	Declination magnet.	Declination.	Mean trace reading. Eschenhagen.	Mean trace reading. Wild.	Base line. Eschenhagen.	Base line. Wild.	Magnetic character.	Observer.
1908.		° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	mm.	mm.	° ′	° ′		
Jan. 10....	9:32– 9:50	274 36 47	102 18 37	172 18 10	168 43 38	3 34 32	37.2	83.7	2 57.8	2 10.8	2	Miller.
Jan. 10....	13:56–14:36	274 36 48	102 18 37	172 18 11	168 36 15	3 41 56	44.4	91.1	2 57.5	2 10.8	2	Gregg.
Jan. 31....	9:33– 9:54	274 36 50	102 18 37	172 18 13	168 40 52	3 37 21	39.8	86.4	2 57.6	2 11.0	3	Miller.
Feb. 11....	7:53– 8:11	274 36 48	102 18 37	172 18 11	168 40 33	3 37 38	40.3	86.8	2 57.8	2 10.8	3	Miller.
Feb. 11....	15:21–15:42	274 36 24	102 18 37	172 17 47	168 34 14	3 43 33	45.9	92.4	2 57.6	2 11.2	3	Miller.
Feb. 19....	9:22– 9:57	274 36 44	102 18 37	172 18 07	168 42 58	3 35 09	37.8	84.2	2 57.4	2 11.0	2	Gregg.
Feb. 19....	14:55–15:27	274 36 47	102 18 37	172 18 10	168 33 36	3 44 34	46.8	93.4	2 57.8	2 11.2	1	Gregg.
Mar. 6....	8:00– 8:21	274 36 50	102 18 37	172 18 13	168 42 20	3 35 53	38.5	84.7	2 57.4	2 11.2	2	Miller.
Mar. 6...	13:15–13:50	274 36 44	102 18 37	172 18 07	168 33 44	3 44 23	46.9	93.0	2 57.5	2 11.4	2	Gregg.
Mar. 17....	7:35– 8:09	274 36 43	102 18 37	172 18 06	168 44 41	3 33 25	36.0	82.1	2 57.4	2 11.0	2	Gregg.
Mar. 17....	14:30–15:00	274 36 45	102 18 37	172 18 08	168 34 58	3 43 10	45.3	92.4	2 57.9	2 10.8	2	Gregg.
Mar. 26....	9:13– 9:35	274 36 41	102 18 37	172 18 04	168 38 41	3 39 23	41.8	88.2	2 57.6	2 11.2	3	Gregg.
May 19....	7:11– 7:40	147 31 15	102 18 37	45 12 38	41 38 37	3 34 01	36.6	75.9	2 57.4	2§ 18.1	2	Miller.
May 19....	14:18–14:47	147 31 12	102 18 37	45 12 35	41 28 09	3 44 26	46.8	86.2	2* 57.6	2 18.2	1	Gregg.
May 26....	6:54– 7:18	147 30 52	102 18 37	45 12 15	41 33 03	3 39 12	42.6	81.7	2 56.6	2 17.5	3	Miller.
May 26....	14:00–14:30	147 30 57	102 18 37	45 12 20	41 26 41	3 45 39	49.0	87.7	2 56.7	2 18.0	2	Gregg.
June 3....	8:34– 9:01	147 31 18	102 18 37	45 12 41	41 29 32	3 43 09	46.0	84.5	2 57.1	2 18.6	3	Gregg.
June 3....	14:41–15:07	147 31 12	102 18 37	45 12 35	41 29 03	3 43 32	46.2	84.6	2 57.8	2 18.9	3	Gregg.
June 9....	8:26– 8:53	147 31 00	102 18 37	45 12 23	41 35 10	3 37 13	40.9	78.5	2 56.3	2 18.7	2	Gregg.
June 16....	9:51–10:09	235 27 58	102 18 37	133 09 21	129 30 59	3 38 22	50.6	79.0	2† 47.8	2 19.4	1	Gregg.
June 16....	15:08–15:26	235 27 59	102 18 37	133 09 22	129 25 33	3 43 49	55.9	84.4	2 47.9	2 19.4	1	Miller.
June 23...	8:37– 8:55	235 27 52	102 18 37	133 09 15	129 32 58	3 36 17	47.9	76.9	2‡ 48.4	2 19.4	2	Miller.
June 23....	15:24–15:42	235 27 56	102 18 37	133 09 20	129 24 22	3 44 58	56.6	86.0	2 48.4	2 19.0	1	Miller.
June 30....	6:36– 6:58	235 25 39	102‖ 16 12	133 09 27	129 30 03	3 39 24	50.7	79.6	2 48.7	2 19.8	2	Gregg.
June 30....	15:13–15:33	235 25 30	102 16 12	133 09 18	129 24 16	3 45 02	56.3	85.4	2 48.7	2 19.6	2	Gregg.

* Changed May 25, 1908, 13 hours. † Changed June 10, 1908, 8 hours. ‡ Changed June 21, 1908, 11 hours. § Changed April 19, 1908, 8 hours.
‖ Collimator disturbed by visitors on June 27, 1908.

TABLE 2.—*Declination, 3° + tabular values (minutes), west; Mount*

Date.	Hours. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
19 ...	37.4	37.4	37.3	36.4	36.5	36.0	35.5	35.4	35.2	35.3	36.7	38.8	40.8	39.9	39.3
20 ...	37.3	37.3	36.8	36.4	36.2	36.1	35.1	33.9	34.3	35.7	37.5	39.2	40.3	40.5	39.5
21 ...	36.9	37.1	37.0	36.6	36.3	35.8≀	34.5≀	46.5≀	39.5≀	[a] ≀	.....≀	43.5≀	46.0≀	48.5≀	45.8≀
22 ...	37.6	37.6	37.1	36.4	36.6≀	35.5≀	40.3≀	36.5≀	34.5	35.1	36.5	42.4≀	40.5	40.8	39.4
23 ...	37.5	37.7	37.8	38.0	38.7≀	36.5	36.8	36.5	35.4	36.6	38.4	40.5	41.3	40.4	39.6
24 ...	37.5	38.1	37.9	37.5	38.2≀	36.7	35.3	34.5	34.0	36.1	38.1	40.4	42.2	41.3	40.3
25 ...	37.4	38.0	37.7	37.6	36.7	36.5	36.2	35.7	34.5	35.5	37.5	40.0	40.5	40.7	39.6
26 ...	37.4	38.4	39.7	37.5	36.2	36.1	36.5	33.9	33.6	34.1	35.5	40.7	42.4	41.3	40.2
27 ...	37.2	38.4	36.5	36.2	35.9	35.5	34.5≀	40.7≀	36.6	35.7	36.4	38.1	39.3	39.3	38.1
28 ..	37.6	37.5	37.4	37.0	36.6	36.2	36.1	35.5	35.3	35.5	36.7	37.5	38.3	39.5	39.0
29 ...	37.5	37.5	37.3	37.1	36.7	36.7	36.5	35.6	34.6	34.7	36.7	38.6	39.8	39.5	38.8
30 ...	37.5	37.5	37.4	36.8	36.7	36.5	36.3	36.2	35.7	36.0	37.7	39.5	39.7	39.3	38.3
M'ns	37.40	37.71	37.49	36.96	36.78	36.13	36.09	36.74	35.27	35.48	37.06	39.93	40.88	40.46	39.82

[a] Register clock removed for repair.

Declination, 3° + tabular values (minutes), west; Mount

1 ...	37.2	37.5	37.1	36.5	36.3	36.2	35.6	35.5	35.1	35.5	36.7	39.8	40.7	41.1	39.8
2 ...	37.4	37.4	37.5	37.2	35.5	35.5	36.2	35.5	35.4	35.6	36.9	38.8	40.5	39.9	38.9
3 ...	37.5	37.5	37.4	36.9	36.6	36.5	36.5	35.7	35.3	35.4	36.3	37.6	39.3	39.5	38.7
4 ...	37.4	37.5	37.6	36.8	36.5≀	37.8≀	36.0≀	35.3≀	38.9≀	36.6	36.2	37.6	39.2	40.5	40.5
5 ...	31.6≀	35.8≀	38.8≀	34.7≀	35.1	35.8	35.7	35.7	35.6	35.4	37.5	[39.8]	[41.0]	[41.3]	[40.6]
6 ...	37.6	37.6	37.4≀	36.5≀	35.8≀	36.4≀	35.5≀	34.5≀	34.5≀	36.6≀	38.3	38.5	40.4	40.5	39.9
7 ...	38.2	37.3	40.4≀	36.4≀	35.5≀	37.1≀	37.6≀	35.8≀	35.5≀	37.7≀	36.8≀	38.9	41.1	41.2	40.8
8 ...	38.0	38.6	37.7	38.2	39.1≀	36.6	36.5	33.7≀	34.5	35.2	36.5	38.1	39.7	40.5	40.2
9 ...	38.4	38.5	38.1	38.2	37.8	36.8	36.0	35.6	34.8	35.4	36.6	38.5	40.3	40.9	40.5
10 ...	38.1	38.0	37.9	38.3	37.5	37.3	36.7	34.7	33.4	35.5	37.6	39.9	44.9≀	46.0≀	43.6≀
11 ...	37.7	37.5	37.1	36.8	37.4≀	37.5≀	37.2≀	35.4≀	34.2≀	34.6≀	36.3≀	39.1≀	44.5≀	42.3≀	41.7≀
12 ...	36.5≀	38.8≀	37.8≀	36.4≀	37.6	36.9	36.1≀	34.5≀	36.8≀	36.5≀	37.4≀	39.5≀	39.8≀	43.4≀	42.2≀
13 ...	37.5	38.5	38.7	39.6≀	38.4≀	38.6≀	37.5	35.8	34.5≀	35.4≀	36.7	38.7≀	40.3	41.1	41.8
14 ...	37.9	40.7≀	38.8	37.8	37.5	36.8	38.6	36.4	34.9	35.6	37.2	39.7	42.6	44.5	42.7
15 ...	38.4	38.2	38.0	37.7	37.7	37.5	37.5	36.6	36.5	36.5	38.5	40.3	41.3	41.4	41.2
16 ...	37.6	39.3	38.4	38.2	38.1	38.1	37.7	36.5	35.7	36.0	38.0	39.6	40.6	40.5	40.4
17 ...	37.4	36.7	36.5	36.5	37.9	37.1	37.7	37.4	38.1	38.5	39.2	40.8	40.5	40.7	40.5
18 ...	38.4	37.4	37.3	37.5	38.4	37.7	37.1	36.5	35.5	36.5	37.7	40.2	42.5	41.7	41.3
19 ...	38.5	38.7	38.6	38.5	37.7	37.7	37.8	37.3	35.9	36.3	37.6	39.6	40.9	41.8	40.9
20 ...	38.9≀	39.4≀	42.8≀	35.7≀	36.5≀	38.3≀	39.4≀	36.5≀	38.4≀	40.7≀	39.7≀	40.3≀	41.5	41.8	40.5
21 ...	39.0	39.1	38.5	38.1	38.6	37.3	36.5	35.5	36.5	37.7	39.6	41.5	42.3	41.1	39.6
22 ...	38.4	39.1	38.6	38.6	38.3	38.5	38.1	36.7	36.6	36.8	38.7	40.6	41.8	41.3	40.6
23 ...	38.9	39.2	38.5	38.9	38.2	38.1	37.8	37.3	36.4	37.5	38.4	39.8	40.1	40.9	39.5
24 ...	38.4	38.6	38.6	38.2	38.3	37.6	37.2	36.3	36.2	36.4	38.5	41.2	42.4	42.5	41.4
25 ...	38.5	39.0	38.7	38.5	37.6	37.8	37.5	36.8	35.8	35.5	36.8	39.3	40.6	41.4	40.5
26 ...	38.1	39.7	39.5	38.1	37.7	38.2	37.7	36.5	36.0	35.4	36.8	39.7	41.3	42.7	42.7≀
27 ...	40.2	38.5	42.4≀	41.4≀	36.7	36.8	38.0	36.8	35.1	34.5	37.5	40.0	41.2	41.4	40.5
28 ...	37.7	38.5	38.4	37.7	37.7	38.5	37.2	35.8	35.4	35.0	36.1	37.7	39.7	40.5	40.6
29 ...	37.7	38.5	38.7	37.8	38.0	38.1	37.5	37.3	35.0	34.8	36.1	37.9	39.8	41.4	41.7
30 ...	37.8	38.1	37.8≀	35.5≀	36.3	36.6	35.5	39.2≀	37.7≀	37.2	36.7	38.9	41.2	41.8	40.5
31 ...	38.4	38.7	37.5	37.5	37.5	37.6	37.5	37.1	35.7	35.9	37.3	39.2	40.2	40.8	40.8
M'ns.	37.85	38.30	38.39	37.55	37.35	37.32	37.08	36.12	35.79	36.20	37.43	39.36	41.70	41.48	40.78

Weather, Va., November, 1907. (75th meridian time.)

Hours.									Means.	Extremes.		Range.	Character.		Date.
16	17	18	19	20	21	22	23	24		Max.	Min.		A.M.	P.M.	
38.5	38.1	37.5	37.3	36.9	36.9	36.9	37.0	37.4	37.25	40.4	34.7	5.7	2	1	19
38.4	37.7	37.3	36.7	36.6	36.5	36.5	36.8	37.0	37.07	40.6	33.7	6.9	2	2	20
46.5~	38.6~	37.6	37.3	36.3	37.2	37.4	37.7	38.0	39.32	55.2~	33.7~	21.5	5	5	21
38.7	37.5	36.8	38.4	37.5	37.4	37.4	37.5	36.6	37.67	42.8~	33.8~	9.0	3	2	22
38.4	37.5	37.3	37.8	37.1	37.0	37.8	37.2	36.6	37.79	41.5	34.5	7.0	3	2	23
39.1	37.7	37.2	36.9	36.5	36.8	36.5	36.8	37.3	37.60	42.5	33.6	8.0	3	1	24
38.7	37.9	37.4	36.9	37.0	36.9	36.7	37.3	37.4	37.51	41.2	34.4	6.8	2	1	25
39.2	37.7	37.2	36.9	36.8	36.6	34.7~	36.7~	35.6~	37.27	42.8	33.5	9.3	2	3	26
37.5	37.4	37.4	36.8	36.6	36.7	37.2	36.5	36.6	37.18	44.8~	34.4~	10.4	3	2	27
38.6	37.9	38.0	36.7	36.7	36.5	36.7	37.2	37.3	37.14	39.6	34.3	5.3	2	2	28
38.3	37.9	37.5	37.3	37.1	37.0	37.0	37.3	37.3	37.26	40.2	34.5	5.7	1	1	29
37.7	37.5	37.4	37.2	36.6	36.6	36.7	36.7	37.3	37.30	40.0	35.5	4.5	1	1	30
39.13	37.78	37.38	37.14	36.77	36.80	36.75	37.06	37.08	37.51	42.63	34.22	8.41	2.4	1.8	M'ns.

Weather, Va., December, 1907. (75th meridian time.)

38.5	38.7	37.5	37.0	36.9	36.6	37.1	36.7	37.2	37.35	41.2	34.5	6.7	2	1	1
38.5	38.8	37.5	37.1	37.0	36.9	37.2	37.4	37.4	37.33	40.7	35.4	5.3	2	1	2
38.5	38.9	37.5	37.1	36.8	36.8	36.8	36.9	37.1	37.21	39.6	35.1	4.5	1	1	3
38.9	38.2	37.3	36.6	36.5	35.7	36.3	31.1~	33.1~	36.98	40.8	27.4~	13.4	3	3	4
39.6	38.7	37.7	37.5	37.5	37.3	36.0	36.8	36.5	37.10	42.2	31.3~	10.9	3	2	5
38.7	38.3	37.5	36.6	36.0	35.6	32.4~	36.6	36.5	37.01	41.4	32.4~	9.0	3	3	6
38.6	37.7~	37.5~	37.5~	36.1~	30.5~	30.0~	31.2~	34.4~	36.80	41.5	28.5~	13.0	3	4	7
38.9	38.2	36.6	37.3	35.8	36.5	36.6	37.2	37.5	37.40	40.6	33.5~	7.1	3	2	8
39.0	38.2	37.7	37.5	37.0	36.8	37.2	37.5	37.6	37.70	41.4	34.2	7.2	2	2	9
43.5~	43.6~	43.7~	39.5~	38.4	35.4	35.5	36.4	37.3	38.86	46.6~	33.2	13.4	2	4	10
41.4~	39.7~	38.1	37.5	36.6	36.4	33.3~	32.6~	36.5~	37.56	46.4~	28.7~	17.7	3	4	11
42.2~	40.6~	35.4~	38.6~	39.6~	35.6~	41.9~	36.1~	37.9~	38.25	43.6~	30.4~	13.2	3	4	12
39.5	38.9	39.5	36.5~	36.9~	36.9~	37.4	37.9	38.3	38.10	42.3~	32.4~	9.9	3	3	13
40.7	40.5	39.2	38.5	37.6	37.5	37.6	37.7	38.1	38.71	44.5	34.7	9.8	3	2	14
40.7	39.9	39.1	38.7	39.5	37.8	37.9	37.5	38.1	38.60	41.6	36.1	5.5	1	2	15
40.3	39.7	38.5	39.2	38.5	38.1~	35.7~	37.7	37.5	38.33	41.3~	35.2~	6.1	1	3	16
40.1	39.5	38.5	38.2	38.0	38.3	37.5	38.4~	37.5	38.40	41.4	34.5~	6.9	2	3	17
40.0	39.5	39.5	38.5	37.7	37.6	37.5	37.5	38.4	38.41	42.6	35.2	7.4	2	2	18
39.5	39.1	38.4	37.8	37.7	35.5	36.7	37.5	37.4	38.22	41.8	34.3~	7.5	2	2	19
39.5	38.3	38.1	37.8	37.6	37.8	38.2	38.6	38.8	38.94	45.9~	35.5~	10.4	3	2	20
38.8	38.7	38.5	38.1	37.5	37.8	37.5	38.2	38.2	38.49	42.5	35.3	7.2	2	2	21
39.7	39.3	37.7	37.8	37.5	36.7	36.7	37.3	38.4	38.47	41.5	36.3	5.2	2	2	22
38.8	38.1	37.5	37.3	36.8	36.9	37.2	37.5	37.6	38.25	42.1	35.5	6.6	2	1	23
39.5	37.9	37.5	37.5	36.8	36.7	36.7	37.2	38.5	38.34	42.7	35.5~	7.2	1	2	24
39.5	38.5	37.7	37.5	37.4	37.2	37.3	37.8	37.5	38.07	41.5	34.8	6.7	2	2	25
40.5~	40.2~	39.4~	38.5~	37.3	37.2	38.0	38.2	38.3	38.65	44.5	34.5	10.0	2	3	26
39.5	38.6	38.2	37.6~	37.5~	37.5	37.8	36.8	37.8	38.39	48.9~	34.3	14.6	3	2	27
40.5	39.7	39.5	36.0~	38.3~	37.5	37.5	37.5	37.5	37.94	41.5	34.5	7.0	2	3	28
40.8	39.3	38.5	38.5	37.3	37.0	37.5	37.4	37.6	38.09	42.0	34.7	7.3	2	2	29
40.5	39.4	38.4	38.2	37.5	37.6	38.0	37.9	37.6	38.14	41.5	35.2~	6.3	3	2	30
40.7	40.0	38.7	38.2	37.6	37.5	37.5	37.6	37.5	38.21	41.4	35.4	6.0	2	2	31
39.85	39.18	38.27	37.75	37.39	36.73	36.77	36.86	37.41	38.01	42.50	33.82	8.68	2.3	2.4	M'ns.

Declination, 3° + tabular values (minutes), west; Mount

Date.	Hours. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 ...	38.8	38.5	38.1	37.7	37.6	37.8	37.5	37.2	36.0	35.2	37.6	39.4	41.0	41.1	40.6
2 ...	39.5ξ	37.5	37.8	37.5	37.5	37.5	38.4	37.2	36.5	36.4	36.8	38.6	39.5	40.7	40.5
3 ...	38.5	38.2	38.7	42.5ξ	38.2	36.8	42.4ξ	37.6	36.8	36.5	38.5	39.9	40.8	40.5	40.2
4 ...	38.5	38.6	38.2	40.4ξ	39.5ξ	37.8	37.8	37.2	38.1	37.9	37.6	39.9	40.5	41.6	41.4
5 ...	38.2	40.1ξ	38.7	38.1	37.6	38.4	37.7	36.5	36.0	36.5	37.8	39.8	44.5ξ	42.6ξ	41.2
6 ...	38.7ξ	38.9ξ	39.4ξ	37.9	37.9	37.7	37.9	36.7	35.4	36.2	37.9	39.4	40.4	40.5	40.4
7 ...	38.6	39.0	38.3	37.5	37.4	37.7	38.6	37.8	38.5	39.1	40.5	42.3	42.9	43.6	44.0
8 ...	37.2	36.1	36.5	38.0	36.5	36.3	38.0	36.9	36.8	37.8	38.3	40.2	41.8	41.5	42.1
9 ...	34.9ξ	32.2ξ	36.6	33.5ξ	49.0ξ	37.5ξ	37.6ξ	38.0ξ	36.2ξ	34.7ξ	37.1ξ	41.5ξ	40.5ξ	40.9ξ	41.0ξ
10 ...	37.7	37.4	38.3	38.3	37.7	38.0	38.5	36.4	34.2	34.4	36.5	39.5	41.3	41.4	42.7
11 ...	38.3	38.4	38.0	38.3	37.6	39.1	39.0	36.5	34.7	35.8	36.5	39.3	41.6	41.4	41.6
12 ...	36.5	37.5	40.1	39.7	37.6	40.4ξ	39.2ξ	37.1	36.4	35.8	36.5	38.8	40.7	41.6	41.3
13 ...	38.3	38.3	38.3	38.2	38.3	39.1	38.3	36.9	35.5	34.4	35.5	37.6	39.1	39.5	40.5
14 ...	38.2	37.9	36.8	37.3	37.6	38.3	37.7	37.4	35.2	34.2	36.5	38.8	39.8	40.2	40.5
15 ...	38.5	37.5	37.4	38.0	37.5	38.8	38.4	38.0	38.1	35.8	37.2	38.6	40.6	40.1	40.4
16 ...	38.7	38.5	38.5	38.4	38.5	38.6	38.8	37.4	35.0	36.0	37.3	38.7	40.5	41.4	42.3
17 ...	38.6	38.6	38.5	38.7	38.5	38.5	37.5	36.7	34.8	35.5	37.3	38.6	39.5	40.3	40.4
18 ...	38.5	38.3	38.0	37.8	38.5	38.3	40.5ξ	36.7	35.5	35.5	37.0	38.4	39.5	39.5	39.5
19 ...	38.4	38.5	38.6	39.7	37.8	38.3	37.8	37.2	35.5	35.7	37.6	39.5	40.8	41.1	40.5
20 ...	38.5	38.6	38.5	38.5	38.3	37.7	37.5	36.5	35.6	34.8	36.8	39.3	40.7	41.3	40.4
21 ...	38.5	38.5	38.6	39.5	37.3	37.4	37.2	36.2	34.6	34.1	36.5	39.2	41.6	42.9	43.2
22 ...	38.9	39.1	38.6	38.5	38.5	37.7	37.6	36.3	34.6	34.7	37.1	39.6	42.4	43.5	42.2
23 ...	38.5	38.9	38.5	39.3	37.4	37.5	37.3	35.3	33.6	33.3	35.5	38.5	41.4	41.9	41.5
24 ...	39.2	39.4ξ	38.7ξ	37.7	37.8	38.5	36.8	[35.6]	34.9	37.5	39.2	41.5	42.9ξ	42.5ξ	40.8
25 ...	37.6	37.9	36.6	36.1	38.3	37.3	37.0	35.4	34.5	36.3	39.6	41.6	42.5	42.0	41.0
26 ...	38.1	37.8	38.4	38.5	38.0	37.9	36.7	38.9	37.6	36.8	37.9	40.5	42.5	42.7	41.7
27 ...	38.9	39.1	38.9	38.5	38.5	38.6	37.6	36.9	33.3ξ	36.2	37.8	39.5	40.5	41.6	41.5
28 ...	38.5	38.4	38.4	38.5	38.2	37.8	37.5	36.5	35.3	34.0	35.4	37.8	40.5	42.2	42.3
29 ...	32.5ξ	29.8ξ	34.5ξ	28.5ξ	38.3ξ	35.5ξ	37.4ξ	35.8ξ	33.8ξ	33.5ξ	35.6	38.5	40.5	41.5	42.1
30 ...	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	34.2	36.9	37.8	39.4	40.7	42.4
31 ...	38.6	39.0	39.0	38.5	39.6	38.2	37.3	34.7	35.5	35.7	36.7	38.7	40.4	40.2	40.0
M'ns.	38.06	37.88	38.10	37.99	38.35	37.95	38.05	36.77	35.62	35.53	37.26	39.38	40.95	41.36	41.30

[b] Light not bright enough to make a legible trace.

Declination, 3° + tabular values (minutes), west; Mount

1 ...	38.6	38.8	38.7	38.7	38.5	38.3	37.7	36.5	35.3	35.5	37.2	40.4	42.6	42.2	41.8
2 ...	38.5	38.5	39.2	39.1	38.4	38.4	38.4	36.5	34.9	34.3	35.9	38.1	39.5	40.2	40.9
3 ..	39.0	39.0	38.5	39.8	38.5	37.4	37.0	35.6	35.4	34.8	39.9	42.1	43.4	45.5	44.5
4 ...	37.8	38.6	38.8	38.7	37.5	38.4	41.2	36.4ξ	35.8ξ	35.4ξ	38.4ξ	38.3	41.2	42.0	40.7
5 ..	35.2ξ	37.5ξ	36.3ξ	45.6	36.6	37.5	37.5	35.0	38.5ξ	36.4ξ	38.8ξ	41.5ξ	42.3ξ	41.5ξ	44.4ξ
6 ...	36.8ξ	37.4ξ	36.4	35.7ξ	40.4ξ	35.6ξ	37.1ξ	35.0ξ	34.9ξ	33.5ξ	36.6ξ	38.8ξ	39.9ξ	42.5ξ	39.8ξ
7 ...	37.6ξ	38.3ξ	39.2ξ	38.7ξ	38.5ξ	38.3ξ	38.3ξ	39.4ξ	37.5ξ	37.4ξ	35.4ξ	38.5	39.4	41.5	43.3
8 ...	38.6	39.2	39.4	38.3	39.3	38.3	37.5	37.0	34.3	32.4ξ	35.5	37.9	40.5	42.7	43.5
9 ...	38.0	39.6	38.5	37.8	38.7	38.4	37.6	36.9	35.1	34.3	34.7	37.6	41.5	42.3	42.8
10 ...	38.4	38.5	38.3	38.5	38.2	37.7	37.5	36.4	33.5ξ	33.4ξ	37.4ξ	36.4	38.5	39.7	41.2
11 ...	38.5	38.5	38.9	39.5ξ	38.8ξ	40.5ξ	38.4ξ	37.4ξ	39.4ξ	38.2ξ	37.4	37.8ξ	42.5ξ	43.7ξ	42.7ξ
12 ...	36.6ξ	44.6ξ	37.7ξ	38.5ξ	38.2ξ	43.7ξ	40.6ξ	40.5ξ	37.6ξ	35.5	35.8	38.2	40.4	40.5	40.9
13 ...	39.4ξ	41.9ξ	39.5ξ	38.4	37.6	38.2	37.6	36.1	35.3	35.3	36.5	38.2	40.6	42.5	42.0
14 ...	39.4	39.3	39.0	38.8	38.6	38.5	38.4	36.8	35.5	35.4	36.1	37.4	40.5	41.5	41.5
15 ...	39.4	40.7	38.5	39.4	37.9	37.7	37.5	37.4	34.5	34.5	36.6	38.8	40.5	41.6	41.5
16 ...	34.7	36.9	39.5	38.4	37.7	37.6	37.5	36.8	35.7	35.8	37.4	38.2	41.0	42.8	43.4
17 ...	38.1	38.0	38.0	37.7	38.0	38.2	37.1	35.0	34.0	34.4	36.4	38.6	41.5	42.8	43.5
18 ..	38.8	38.7	38.4	38.4	37.7	38.0	37.5	35.5	34.3	35.5	37.4	40.3	42.5	42.7	41.3
19 ...	38.6	38.6	39.1	38.7	37.8	37.5	38.2	34.8	35.3	36.2	38.6	40.5	41.9	44.1	44.4
20 ...	39.3	39.4	39.2	38.7	38.4	38.4	37.5	35.3	34.2	35.5	37.7	40.5	43.2	44.1	43.5
21 ...	38.7	38.8	38.6	38.5	38.0	37.8	37.8	36.5	35.1	35.8	36.6	39.6	42.6	44.0	43.8
22 ...	38.8	38.7	38.6	38.6	37.9	37.6	37.4	34.4ξ	31.5ξ	32.6ξ	36.6ξ	43.4ξ	44.4ξ	46.5ξ	46.6ξ
23 ...	36.8ξ	35.1ξ	37.5ξ	38.1ξ	35.6ξ	37.7ξ	40.5ξ	35.7ξ	34.2ξ	34.5	36.5	39.5	42.5	43.3	42.7
24 ...	38.5	37.6	37.5	37.4	36.7	37.5	37.4	33.6ξ	36.5ξ	37.8ξ	37.3	38.4	40.4	41.7	42.5
25 ...	38.0	38.6	38.5	38.5	38.4	38.7	37.9	36.8	36.4	35.9	36.2	38.5	41.9	43.5	43.3
26 ...	39.4	39.5	39.1	39.0	38.5	37.8	37.9	36.8	38.1	36.7	38.1	40.8	41.7	42.5	41.6
27 ..	38.2	39.2	39.1	38.5	38.5	38.2	37.5	35.6	34.9	35.3	37.5	40.4	42.9	41.6	40.5
28 ...	38.6	37.6	38.5	38.8	37.4	36.6	37.5	35.5	35.2	37.5	41.1	41.6	41.6	41.3	39.9
29 ...	38.8	38.8	38.7	38.4	37.7	37.5	35.9	34.9	33.2	36.4	40.1	44.3ξ	45.5ξ	47.4ξ	46.0ξ
M'ns.	38.18	38.82	38.52	38.71	38.07	38.14	37.91	36.21	35.38	35.28	37.23	39.45	41.62	42.70	42.57

Weather, Va., January, 1908. (75th meridian time.)

Hours. 16	17	18	19	20	21	22	23	24	Means.	Extremes. Max.	Min.	Range.	Character. A.M.	P.M.	Date.
39.6	38.6	37.9	37.6	37.5	36.7	37.8	38.2	38.4	38.16	41.4	34.6	6.8	2	2	1
40.2	38.7	37.9	38.0	37.4	36.5	37.4	37.3	38.3	38.07	41.2	34.6	6.6	3	2	2
40.2	39.4	39.2	38.4	37.9	37.6	37.7	37.8	38.1	38.33	43.5≶	35.8	7.7	3	2	3
40.5	39.4	38.7	37.9	38.1	37.6	37.5	37.0	38.3	38.75	41.7	36.2≶	5.5	3	1	4
41.5	40.6	38.4	38.4	37.2	37.4	36.3≶	33.5≶	38.3≶	38.55	44.8≶	32.5≶	12.3	2	3	5
40.2	39.3	38.2	38.3	37.7	37.6	38.3	38.5	38.3	38.40	41.3≶	35.3	6.5	3	1	6
42.4	42.2	39.9	40.3	40.5≶	37.8	36.5	36.5	36.2	38.50	44.5	35.1≶	9.4	1	2	7
40.8	39.3	38.5	38.2	38.9	39.7≶	33.5≶	35.5	36.6	38.10	43.6≶	30.4	13.2	2	4	8
42.7≶	39.1	39.5	38.5	38.0	36.2≶	36.5	37.2	37.3	38.18	49.3≶	31.8≶	17.5	5	3	9
42.0	41.8	40.6≶	40.5≶	38.6	37.5	37.2	37.6	37.6	38.57	42.9	33.8	9.1	2	2	10
42.5	39.5	39.7	38.9	37.7	37.5	37.5	37.5	37.5	38.50	43.0	34.7	8.3	2	2	11
40.8	39.8	38.5	37.6	36.6	38.5	37.7	37.7	37.8	38.51	42.3	35.0≶	7.3	2	2	12
40.6	40.1	39.2	38.5	38.3	38.2	38.5	38.3	37.8	38.22	40.8	34.2	6.6	1	2	13
40.6	39.5	39.2	38.5	38.3	37.5	37.3	38.0	38.4	38.01	40.8	33.9	6.9	2	2	14
40.6	39.3	38.4	38.0	37.4	37.5	37.5	38.5	38.5	38.32	40.7	34.8	5.9	2	2	15
40.7	[39.7]	38.6	38.2	37.9	37.6	38.1	38.2	37.5	38.55	42.4	34.8	7.6	2	1	16
40.3	39.5	38.5	38.2	38.1	38.2	38.3	38.2	38.4	38.32	40.6	34.5	6.1	1	1	17
39.5	36.6≶	38.5	38.3	37.7	37.6	37.9	38.5	38.2	38.10	40.9≶	34.9	6.0	3	1	18
39.4	38.6	38.4	38.0	37.7	37.7	37.9	38.2	38.5	38.39	41.1	35.0	6.1	1	1	19
39.5	38.7	38.3	38.2	37.9	37.5	37.5	38.0	38.4	38.21	41.3	34.5	6.8	1	1	20
41.5	40.2	39.5	38.8	38.0	37.2	37.2	34.9≶	38.6	38.38	43.5	33.5	10.0	2	2	21
40.3	38.9	38.5	38.1	37.6	37.5	37.6	37.9	38.8	38.50	43.5	34.1	9.4	1	1	22
[40.5]	[39.5]	38.5	37.6	37.5	37.5	37.5	37.6	37.4	38.00	42.1	32.8	9.3	2	1	23
40.4	39.3	38.7	38.5	37.5	36.5	36.6≶	36.7	38.0	38.53	43.0≶	30.3≶	12.7	3	3	24
40.5	40.1	38.8	38.7	38.8	37.8	38.4	35.9≶	37.0	38.32	42.5	31.2≶	7.1	2	3	25
41.4	39.9	39.4	39.0	38.7	38.5	38.6	38.5	39.0	39.04	43.2	36.2	7.0	3	1	26
41.2	40.4	42.3≶	41.4≶	38.6≶	37.1	38.0	36.4≶	38.4	38.80	42.6≶	32.3≶	10.3	3	3	27
40.7	39.2	38.5	38.6	37.6≶	37.7≶	36.6≶	31.5≶	29.6≶	37.55	42.5	29.6≶	12.9	2	3	28
42.5	41.8	40.5	39.2	37.9	37.7	38.4≶	b	b	37.04	43.0	26.7≶	16.3	4	3	29
43.2≶	41.5≶	39.9	39.2	[38.7]	38.2	38.2	38.0	38.5	....	43.4	......	......	.....	3	30
39.8	38.9	38.5	38.6	37.6	38.0	37.7	37.8	38.4	38.22	40.7	34.5≶	6.2	3	2	31
40.86	39.64	39.02	38.59	38.00	37.62	37.72	37.18	37.72	38.37	42.52	33.59	8.98	2.3	2.0	M'ns.

Weather, Va., February, 1908. (75th meridian time.)

16	17	18	19	20	21	22	23	24	Means.	Max.	Min.	Range.	A.M.	P.M.	Date.
41.5	39.7	39.3	38.9	38.4	38.2	38.4	38.0	38.2	38.81	42.6	34.4	8.2	2	2	1
40.5	39.6	38.7	38.5	38.4≶	38.2	38.2	38.5	38.6	38.33	41.3	34.2	7.1	2	1	2
45.8≶	43.4≶	40.5	38.5	38.1	37.7	35.8≶	36.2	37.5	39.31	47.0≶	27.9≶	19.1	1	3	3
41.4	42.2	39.7	38.4	38.7≶	38.5≶	35.6≶	33.9≶	36.5≶	38.50	42.4≶	28.5≶	13.9	3	3	4
44.9≶	43.8≶	43.2≶	35.4≶	39.4≶	37.3≶	36.7≶	35.5≶	35.5≶	39.01	46.4≶	33.4≶	13.0	4	3	5
42.7≶	42.5≶	37.4≶	39.6≶	37.5≶	37.5≶	37.5≶	37.3≶	37.5≶	37.89	48.3≶	32.5≶	15.8	3	3	6
41.9	41.4≶	36.3≶	39.5≶	33.4≶	37.8	38.2	38.0	39.6≶	38.53	44.3≶	33.4≶	10.9	3	3	7
43.3	41.0	39.3	38.7	38.5	38.5	37.9	37.7	37.7	38.62	43.9	32.4≶	11.5	3	2	8
43.6	42.0	39.5	39.3	38.5	38.5	38.2	37.8	37.7	38.70	43.6	34.3	9.3	2	2	9
40.9	40.6	39.5	39.3	39.4	38.6	38.1	38.5	38.5	38.21	41.2	32.5≶	8.7	3	2	10
43.4≶	41.6≶	40.4≶	39.7≶	39.1≶	30.9≶	34.6≶	36.5≶	36.3≶	38.95	45.1≶	26.6≶	18.5	3	4	11
41.4	38.8	38.5	38.5	37.4≶	35.5≶	37.4	37.9	36.7	38.81	46.7≶	28.5≶	18.2	4	4	12
40.7	39.6	39.4	39.1	38.7	39.0	38.3	38.5	38.6	38.79	47.3≶	34.6	12.7	4	1	13
40.5	40.1	38.9	38.5	37.5	38.6	38.5	38.5	38.5	38.60	42.5	35.1	7.4	1	2	14
40.5	39.1	38.8	38.5	38.2	38.1	38.3	38.5	38.6	38.55	41.9	33.6	8.3	2	1	15
43.3	41.8	39.0	39.0	38.2	37.3	37.2	37.1	38.0	38.51	44.2	34.6≶	8.6	2	1	16
42.5	40.4	39.5	39.3	37.5	38.5	38.5	38.6	38.6	38.53	44.2	34.0	10.2	1	1	17
40.5	40.3	40.1	39.6	39.1	37.5	37.4	37.6	38.9	38.67	43.5	33.7	9.8	1	2	18
43.6	42.7	41.4	40.3	38.3	38.0	37.8	38.5	39.3	39.34	44.6	34.6	10.0	2	1	19
41.7	39.9	39.5	39.0	38.6	38.4	38.4	38.5	38.7	39.07	44.1	34.0	10.1	1	1	20
42.5	40.5	38.8	38.7	38.6	38.5	38.3	38.4	38.4	38.91	44.2	34.7	9.5	1	1	21
45.0≶	43.5≶	42.5≶	43.5≶	39.8≶	35.6≶	39.3≶	38.1≶	37.5≶	39.52	48.7≶	29.8≶	18.9	3	3	22
41.0	40.4	39.8	39.6	39.8	43.2≶	37.4	38.3	38.3	38.67	44.0	30.0≶	14.0	3	2	23
41.4	40.1	38.9	38.9	39.3	38.3	36.7	38.5	38.6	38.40	42.8	32.9≶	9.9	3	2	24
41.5	39.8	39.5	39.0	39.2	36.5	32.4≶	37.8≶	38.4	38.55	43.6	31.7≶	11.9	2	2	25
41.0	39.5	39.6	39.2	38.7	38.6	38.6	33.0≶	38.8	38.94	42.5	31.7≶	10.8	2	1	26
39.6	39.5	39.5	39.3	39.0	38.5	38.6	38.7	39.2	38.74	44.2	32.9	11.3	2	1	27
39.5	39.0	38.7	39.3	38.6	38.6	39.1	39.2	38.8	38.73	42.4	33.9	8.5	2	2	28
43.6≶	42.5≶	40.5≶	41.5≶	35.8≶	33.5≶	34.7≶	36.8≶	37.7≶	39.18	47.5≶	27.9≶	19.6	2	3	29
42.06	40.87	39.54	39.19	38.33	37.72	37.45	37.60	38.11	38.74	44.31	32.36	11.95	2.3	2.0	.....

Declination, 3° + tabular values (minutes), west; Mount

Date.	Hours. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 ...	43.5≀	40.2≀	35.8≀	37.9≀	36.5≀	36.4≀	33.5≀	31.4≀	33.2≀	36.6≀	39.6≀	42.8≀	44.6	45.7≀	42.1≀
2 ...	39.8≀	37.6≀	42.5≀	34.8≀	38.3≀	42.6≀	39.1≀	33.8≀	33.8≀	36.5≀	39.0≀	41.5≀	41.5≀	44.5≀	44.6≀
3 ...	37.9≀	37.2≀	39.2≀	43.3≀	37.9≀	37.5≀	36.3≀	34.8≀	34.4≀	36.4≀	37.7≀	40.3≀	42.5≀	39.8≀	42.6≀
4 ...	37.4≀	39.7≀	41.5≀	38.5≀	37.7≀	38.5≀	36.3≀	37.3≀	34.9≀	38.1≀	39.0≀	42.2≀	44.4≀	42.1≀	44.4≀
5 ...	43.0≀	40.5≀	38.8≀	38.2≀	39.4≀	40.5≀	40.3≀	37.5≀	34.5	35.7	38.2	41.1	42.4	43.5	42.8
6 ...	39.0	40.4	39.3	39.3	38.1	39.7	37.6	36.1	35.5	37.5	40.1	43.5	44.4	44.2	43.6
7 ...	40.0	39.2	39.5	38.5	38.3	38.3	36.7	36.0	35.5	36.8	39.2	41.5	42.8	43.2	42.4
8 ...	37.1≀	37.8≀	36.5≀	36.6≀	34.8≀	32.9≀	35.5≀	36.7≀	35.5≀	42.5≀	40.1≀	41.3≀	44.4≀	43.8≀	42.4≀
9 ...	36.7≀	38.1≀	32.4≀	39.8≀	36.2≀	47.7≀	41.1≀	34.6≀	36.2≀	37.1≀	39.4≀	41.0≀	41.5≀	41.5≀	40.7≀
10 ...	39.8≀	38.8≀	40.5≀	40.6≀	39.1≀	38.6≀	37.5	36.2	36.5	37.4	39.4	40.9	41.8	42.2	42.2
11 ...	38.6≀	38.7≀	39.5≀	42.3≀	38.2≀	37.5	35.8	35.3	36.2	36.8	38.6	41.5	43.5	41.5	41.4
12 ...	39.2	38.8	38.5	38.4	38.4	38.2	37.1	37.0	37.0	38.4	40.2	41.8	42.2	41.3	40.4
13 ...	39.1	39.0	39.0	38.8	38.5	38.1	37.1	36.1	36.5	37.6	39.6	41.6	43.4	43.1	41.6
14 ...	39.3	38.9	38.6	38.5	38.3	37.6	36.2	35.4	35.4	37.2	40.7	42.6	43.4	42.5	41.5
15 ..	38.8	38.8	38.7	38.5	38.3	37.8	36.3	35.4	35.4	37.1	39.0	41.3	42.5	42.5	42.3
16 ...	39.2≀	38.0≀	37.1≀	34.1≀	42.4≀	32.1≀	32.5≀	33.3≀	35.4≀	39.5≀	42.9≀	44.5	45.7	45.1	41.8
17 ...	38.5	38.5	38.2	37.8	35.7	35.8	34.0	33.3	35.2	38.1	42.6	44.5	45.6	44.9	42.1
18 ...	38.9	39.1	38.5	38.4	37.6	36.5	35.8	33.6	34.3	36.5	40.3	42.5	44.5	45.4	44.2
19 ...	39.5≀	38.8	38.6	38.1	37.9	36.8	34.8	32.6	32.0	32.7	38.1	42.4	44.5	45.5	44.6
20 ...	38.5≀	39.2≀	38.8	38.4	37.6	36.5	35.5	34.4	32.8≀	35.5	39.9	43.6	46.8	44.9	43.2
21 ...	39.2≀	39.0≀	39.2≀	41.7≀	38.0≀	36.6≀	35.8≀	34.7≀	31.6≀	32.4	37.4	43.5	45.6	45.5	45.3
22 ...	39.3	38.8	38.7	39.2	38.4	37.4	36.7	35.4	34.5	36.5	39.9	43.6	46.1	45.4	43.8
23 ...	39.5	38.9	40.4	38.1	38.3	37.2	35.5	34.5	34.7	36.1	40.1	43.5	45.6	45.5	44.4
24 ...	38.9	39.3	38.5	38.8	38.8	38.5	37.3	35.6	34.5	35.0	38.0	41.0	43.4	44.2	43.6
25 ...	39.2≀	36.8≀	38.4	38.5	38.5	38.5	37.5	35.8	34.5	35.9	37.7	41.5	43.2	44.5	44.4
26 ...	38.8	38.9	38.5	38.0	38.5≀	38.2≀	39.9≀	37.7≀	36.5≀	42.2≀	40.4≀	41.4≀	40.0≀	52.8≀	56.1≀
27 ...	29.4≀	24.9≀	57.8≀	40.0≀	37.3≀	36.9≀	35.7≀	35.4≀	33.7≀	37.2≀	37.5≀	43.9≀	46.0≀	44.5≀	47.6≀
28 ...	40.5≀	42.1≀	38.0≀	42.8≀	39.6≀	41.1≀	40.5≀	36.5≀	35.4≀	37.5≀	38.5≀	41.5≀	43.2≀	42.5≀	42.6≀
29 ...	38.8≀	40.7≀	42.2≀	38.5≀	39.9≀	37.8≀	36.9≀	37.5≀	41.6≀	39.3≀	43.8≀	43.6≀	44.4≀	44.0≀	43.2≀
30 ..	41.4≀	36.8≀	35.5≀	38.6≀	37.0≀	37.3≀	37.3≀	37.1≀	40.5≀	40.4≀	41.2≀	44.1≀	44.9≀	44.8≀	44.4≀
31 ...	40.3≀	40.4≀	40.5≀	39.2≀	39.5≀	37.6≀	37.5≀	35.7≀	36.5≀	37.6≀	43.3≀	45.5≀	44.5≀	44.7≀	43.8≀
M'ns.	39.00	38.51	39.31	38.85	38.16	37.96	36.75	35.38	35.30	37.23	39.72	42.44	43.83	44.05	43.54

Declination, 3° + tabular values (minutes), west; Mount

1 ...	39.4≀	40.5≀	39.5≀	39.6≀	43.1≀	39.5≀	36.1	35.2	35.0	36.5	40.4	42.8	44.1	43.6	43.7
2 ...	40.7	40.5	39.5	42.4≀	39.5≀	37.4	35.5	33.5	33.5	35.3	39.9	44.4	46.1	46.3	44.8
3 ...	39.5	39.6	38.6	38.1	38.6	36.4	36.9	36.8	35.9	36.7	39.1	42.5	45.5	45.7	44.5
4 ...	39.6	40.1	39.4	38.9	38.9	37.2	35.5	34.9	35.3	36.5	36.9	41.6	45.1	46.0	44.5
5 ...	34.6≀	39.0	39.0	38.6	38.3	37.1	35.0≀	32.8≀	34.9≀	36.9	37.5	39.1	43.7≀	48.4≀	47.6≀
6 ...	39.1≀	38.7≀	36.9≀	39.7≀	37.6≀	38.1≀	46.6≀	42.5≀	36.9≀	35.0≀	34.5≀	41.5	44.5	45.9	45.3
7 ...	35.3≀	37.3≀	41.8≀	35.4≀	36.3≀	42.7≀	42.9≀	40.6≀	38.2≀	38.5	39.7	40.9	42.3	43.8	44.5≀
8 ..	34.9≀	35.9≀	39.1≀	38.6≀	41.3≀	39.2≀	37.9≀	36.7≀	36.0	38.1	39.5	41.4	42.6	43.5	43.8
9 ...	39.4	39.4	39.0	38.8≀	38.8≀	37.8	37.1	37.0	37.1	38.1	39.5	41.3	42.8	43.7	44.6
10 ...	39.3	38.7	38.6	38.3	39.3	38.5	38.6	37.1	34.8	34.4	37.4	41.0	44.1	45.4	45.2
11 ...	39.7	39.5	39.5	39.2	39.0	38.3	37.1	36.4	35.7	38.1	41.3	43.5	44.1	44.2	43.4
12 ...	39.4	39.4	38.7	38.9	39.5	37.0	35.7	35.5	35.8	36.7	39.7	42.6	43.9	44.8	44.1
13 ...	38.6	37.8	38.1	37.5	37.6	37.5	36.6	35.7	35.8	38.0	39.8	42.5	43.5	43.1	42.5
14 ...	39.1	38.4	38.5	38.1	37.4	36.5	35.6	34.7	35.6	36.5	38.6	41.6	44.3	45.5	44.5
15 ...	39.6≀	38.2≀	36.4≀	34.2≀	34.4≀	33.7≀	33.3≀	35.3≀	32.5≀	38.6≀	43.8≀	45.9≀	49.8≀	48.5≀	50.5≀
16 ...	41.2	41.3	39.9	39.4	39.3	37.5	37.6	35.4	36.2	36.5	39.5	42.6	45.3	46.1	45.4
17 ...	39.6≀	44.7≀	39.8≀	39.2≀	38.1≀	37.3≀	37.5≀	35.8≀	35.6	36.3	39.0	43.5	47.5≀	47.4≀	45.5≀
18 ...	39.5	39.7	38.4	39.3	38.7	37.5	36.2	34.7	35.7	36.9	41.6	45.6	48.2≀	48.6≀	47.8
19 ...	39.5	39.4	38.6	38.6	39.2	36.8	36.7	35.3	•	......	......	40.7	43.8	44.0	43.1
20 ...	39.2	39.1	39.0	38.7	38.5	37.3	•	......	......	......	......	40.8	42.0	42.8	43.1
21 ...	39.6	39.6	39.3	39.2	38.7	37.5	37.2	36.3	36.5	37.7	39.6	42.6	44.8	44.5	43.8
22 ...	38.9	38.6	•	......	......	......	......	......	36.9	37.6	38.4	44.1	45.4	45.9	45.5
23 ...	39.4	39.2	39.1≀	36.5≀	31.5≀	34.4≀	37.3≀	39.5≀	38.4≀	38.8≀	41.1≀	40.7	43.6	43.4	44.2
24 ...	38.6	38.6	38.6	38.5	38.3	36.7	35.6	35.0	36.5	35.9	37.2	41.8	45.2	46.7	45.5
25 ...	39.1	39.2	38.5	38.2	38.1	36.5	36.2	34.5≀	36.2	37.3	37.3	42.4	44.9	44.0	44.6
26 ...	•	......	......	......	......	......	......	......	37.6	39.1	41.7	44.3	46.3	47.5	44.6
27 ...	38.2≀	42.3≀	43.4≀	41.1≀	39.5≀	39.4≀	39.5≀	36.6≀	34.4≀	39.9≀	43.6≀	45.3	45.1	44.5	44.4
28 ...	39.3	39.3	40.9≀	37.6≀	37.6	37.2	35.8	37.2	35.5	39.0	42.6	45.3	46.5	46.4	45.3
29 ...	40.7≀	38.5≀	39.8≀	38.2≀	39.8≀	38.4	35.1	34.5	34.6	37.3	41.5	43.5	45.8	46.8	46.1
30 ...	38.4	39.4	39.5	38.9	38.9	40.4≀	37.2	35.3	35.5	36.6	39.2	42.5	44.5	45.9	45.5
M'ns.	38.94	39.38	39.18	38.56	38.42	37.64	37.12	36.10	35.81	37.24	39.64	42.61	44.83	45.43	44.93

Weather, Va., March, 1908. (75th meridian time.)

Hours.									Means.	Extremes.		Range.	Character.		Date.
16	17	18	19	20	21	22	23	24		Max.	Min.		A.M.	P.M.	
44.7	40.5	42.4	42.6	37.6	40.9	34.3	38.9	37.9	39.15	48.6	22.0	26.6	4	4	1
43.4	43.1	36.8	39.6	38.3	38.1	35.7	37.1	38.6	39.19	45.3	29.7	15.6	4	4	2
40.7	39.5	38.9	39.2	38.6	32.5	32.5	32.4	35.6	37.82	46.2	30.2	16.0	3	3	3
44.3	42.8	34.8	39.5	39.0	30.8	36.2	38.9	40.5	39.12	45.6	28.2	17.4	3	4	4
41.3	40.1	39.8	39.8	39.4	39.3	38.3	38.7	38.8	39.66	43.5	33.6	9.9	3	2	5
42.5	41.9	41.3	40.2	39.6	39.4	39.2	38.5	39.5	40.02	44.5	35.3	9.2	2	2	6
41.5	41.0	39.0	39.5	39.7	39.2	38.8	36.9	35.5	39.12	43.3	33.0	10.3	2	3	7
41.7	41.8	39.6	38.6	37.7	37.8	38.1	37.7	37.3	38.68	44.8	31.8	13.0	4	3	8
39.8	39.4	39.2	39.6	36.7	39.3	35.2	38.0	37.9	38.71	48.3	29.1	19.2	4	3	9
40.9	40.3	39.4	39.6	39.3	38.5	37.5	39.2	37.5	39.32	42.7	35.6	7.1	3	3	10
40.5	39.9	39.4	36.6	37.2	37.9	39.6	39.5	39.8	38.97	43.6	35.1	8.5	3	3	11
39.4	38.9	39.9	40.2	39.7	39.5	39.5	39.2	39.1	39.26	42.4	36.3	6.1	2	1	12
39.9	39.4	40.2	40.3	39.9	39.5	39.5	39.3	39.2	39.47	43.5	35.8	7.7	1	1	13
40.2	39.5	40.1	40.1	39.8	39.5	39.5	39.3	39.3	39.81	43.5	34.5	9.0	1	1	14
41.5	41.3	40.5	40.5	40.2	39.5	39.3	39.3	38.6	39.81	42.7	34.7	8.0	1	2	15
40.5	39.7	39.1	40.1	39.4	39.6	37.9	39.3	37.5	38.99	46.5	30.4	16.1	4	3	16
41.0	39.5	39.3	38.7	39.9	39.2	38.5	38.8	39.2	39.12	45.6	32.6	13.0	2	2	17
42.1	40.7	39.7	39.5	38.5	34.5	37.1	37.6	38.6	38.91	45.4	32.8	12.6	2	3	18
44.0	41.4	41.6	41.9	42.8	37.5	34.2	32.5	38.4	38.80	45.5	31.5	14.0	3	3	19
43.7	43.5	42.5	35.8	38.6	35.0	36.8	35.3	37.0	38.87	46.5	31.8	14.7	3	3	20
43.2	41.3	40.5	38.2	32.5	37.5	38.6	39.1	39.5	39.00	45.9	30.5	15.4	3	3	21
41.5	39.7	39.2	36.7	39.4	37.9	37.8	38.9	38.7	39.27	46.4	33.6	12.8	2	3	22
42.6	40.8	40.1	39.6	39.6	39.5	39.1	39.1	39.3	39.67	46.0	33.7	12.3	2	1	23
42.3	40.7	40.2	39.5	39.5	39.5	39.5	39.1	34.9	39.19	44.2	34.4	9.8	2	3	24
43.8	42.8	42.2	40.9	40.2	39.6	39.5	39.4	39.2	39.69	44.6	34.3	10.3	3	1	25
52.7	40.8	51.5	43.6	34.5	27.7	30.3	44.5	21.9	40.31	60.0	7.5	52.5	3	5	26
42.1	48.4	43.9	30.0	34.1	39.4	25.3	35.5	39.7	38.59	59.5	16.4	43.1	5	5	27
42.8	32.0	40.1	41.8	37.4	37.4	33.3	35.5	37.5	39.17	49.5	29.5	20.0	5	4	28
42.8	40.2	40.7	36.8	33.5	40.0	38.6	39.6	39.7	40.17	45.6	30.7	14.9	4	4	29
41.0	40.2	40.3	38.9	39.0	39.9	38.6	39.6	41.6	40.02	45.4	34.8	10.6	3	3	30
43.4	39.5	39.6	40.6	40.5	38.9	39.6	39.4	41.5	40.40	45.5	35.1	10.4	3	3	31
42.32	40.66	40.38	39.87	38.45	37.90	37.01	38.26	38.03	39.27	46.15	31.11	15.04	2.9	2.8	M'ns.

Weather, Va., April, 1908. (75th meridian time.)

43.4	41.6	40.3	40.6	39.6	37.8	36.1	39.4	38.1	39.83	44.3	34.1	10.2	3	3	1
42.8	40.2	39.2	40.0	39.9	39.6	37.3	40.6	40.2	39.96	46.5	32.8	13.7	3	3	2
42.6	41.2	40.8	40.8	38.7	36.4	38.9	39.6	39.8	39.72	46.3	35.5	10.8	2	3	3
42.9	41.6	40.5	40.2	39.8	39.9	40.3	39.3	42.1	39.88	46.0	34.5	11.5	2	3	4
45.8	43.1	41.7	40.5	40.3	39.5	39.3	39.5	39.5	39.65	49.3	32.6	16.7	3	3	5
43.9	41.9	40.8	40.2	39.5	38.7	38.3	38.9	34.5	39.98	47.5	30.7	16.8	4	3	6
45.5	45.8	42.1	33.6	40.4	37.5	42.3	36.2	35.4	39.96	46.5	26.4	20.1	4	4	7
43.5	43.1	41.5	40.5	40.3	39.7	39.6	39.5	39.5	39.82	44.0	34.2	9.8	3	1	8
44.5	42.8	41.3	40.7	40.0	39.7	39.5	38.8	40.4	40.09	45.0	36.4	8.6	3	3	9
44.4	42.5	40.9	40.3	40.2	40.3	39.8	39.7	39.5	39.93	45.8	34.2	11.6	2	1	10
42.4	41.5	41.0	40.8	40.2	38.7	38.4	39.5	39.6	40.02	44.5	34.5	10.0	2	2	11
42.5	41.5	40.6	40.5	40.4	40.1	39.7	39.5	39.6	39.84	45.1	34.7	10.4	2	1	12
41.5	40.2	39.6	40.4	40.4	40.3	40.2	40.1	40.2	39.48	43.7	35.7	8.0	2	1	13
42.6	41.2	39.5	40.5	40.4	40.5	40.5	40.5	40.7	39.64	45.7	34.3	11.4	2	2	14
49.2	47.5	40.3	42.5	41.4	33.9	32.6	39.5	39.7	40.05	52.7	32.1	20.6	3	4	15
43.8	41.8	40.6	40.6	35.2	39.6	39.4	40.4	39.8	40.18	46.2	33.7	12.5	2	3	16
43.5	41.5	40.7	40.7	38.2	36.9	38.3	39.8	38.4	40.18	48.5	33.7	14.8	3	3	17
44.9	42.7	41.8	40.6	40.2	40.1	39.5	39.7	39.5	40.70	49.0	34.5	14.5	2	3	18
42.1	40.8	40.0	39.8	39.7	39.7	39.6	39.6	39.5	......	44.3	......	......	2	1	19
*	......	40.5	39.6	39.6	39.8	39.5	39.8	39.7	......	43.1	......	......	1	1	20
*	......	40.5	40.1	40.1	40.1	39.9	39.8	39.1	......	44.5	35.5	9.0	2	1	21
44.0	40.2	40.1	39.7	40.6	40.3	40.1	39.7	39.5	......	46.2	......	......	2	3	22
42.6	41.0	41.6	39.2	30.5	36.5	37.6	38.1	39.2	38.89	44.7	28.3	16.4	3	3	23
44.0	41.7	40.5	39.5	36.9	36.1	39.7	41.9	43.2	39.68	46.9	34.2	12.7	2	3	24
42.5	42.7	42.2	41.7	33.5	39.2	40.4	38.8	*	39.48	45.5	33.4	12.1	2	3	25
43.7	42.5	41.5	38.1	39.9	38.0	38.7	36.7	37.6	......	47.9	......	......	.....	3	26
43.2	41.3	38.8	40.4	41.3	41.2	40.5	40.8	40.2	41.02	45.6	34.4	11.2	3	3	27
43.4	41.5	39.9	40.4	40.5	39.3	31.5	36.4	39.3	39.90	46.6	31.3	15.3	3	3	28
44.4	41.5	40.5	36.7	40.6	40.1	39.0	39.3	39.8	40.08	47.3	33.3	14.0	3	3	29
44.4	42.5	40.6	40.4	39.9	39.5	34.7	38.5	36.6	39.78	46.4	32.0	14.4	3	3	30
43.71	42.05	40.65	39.97	39.27	38.97	38.71	39.30	39.32	39.96	46.19	33.35	12.84	2.5	2.5	M'ns.

* Trace illegible.

Declination, 3° + tabular values (minutes), west; Mount

Date.	Hours.														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 ...	38.6≀	39.4≀	39.7≀	37.5	36.5	34.6≀	34.0≀	34.8≀	35.6≀	35.5≀	44.2≀	47.8≀	48.5≀	47.5≀	46.3≀
2 ...	36.5≀	38.8≀	42.5≀	41.1≀	36.7≀	34.6≀	39.5≀	40.1≀	36.0≀	36.9≀	42.6≀	44.9≀	45.9≀	46.0	43.9
3 ...	40.2	40.5	39.5	40.4	37.7≀	36.4	37.2	35.4	36.5	37.6	39.8	42.0	43.6	44.0	44.4
4 ...	37.8≀	42.2≀	40.3≀	39.8≀	39.8≀	38.7≀	37.4≀	34.1≀	32.4≀	37.6≀	39.7≀	42.9	44.1	44.3	44.0
5 ...	43.1≀	39.8≀	39.0≀	40.3≀	39.1	36.3	35.5	34.6	35.5	37.8	40.2	42.5	43.3	44.5	44.5
6 ...	38.3≀	40.5≀	40.5≀	40.5≀	39.6	36.9	35.3	34.1	34.5	36.9	39.5	42.5	44.9	44.7	43.8
7 ...	38.0	37.8	38.3	38.8	38.7	37.2	36.5	35.6	36.8	38.6	40.8	42.2	43.3	43.7	42.9
8 .	37.6≀	36.5≀	37.0≀	36.9≀	38.0≀	35.5≀	36.2≀	37.7≀	35.4≀	39.1	42.4	43.8	44.3	44.3	43.6
9 ...	39.2	39.6	39.6	40.5	38.6	37.4	36.6	36.6	37.2	38.1	41.4	44.4	43.8	42.8	41.5
10 ...	39.3	39.4	39.5	38.5	37.5	35.5	33.5	32.7	35.1	35.7	40.8	42.6	44.2	45.4	45.9
11 ...	40.8≀	39.6	39.1	38.7	37.1	34.6	34.5	34.0	35.6	38.9	42.4	45.1	45.5	45.3	44.1
12 ...	38.6≀	39.5	38.8	38.6	37.5	36.6	36.0	37.6	40.1	43.6	42.9	44.5	45.2	44.8	43.1
13 ...	51.3≀	37.6≀	37.2≀	37.4	36.6	35.6	36.1	35.5	36.4	40.0	43.4	45.5	47.8	46.7	44.7
14 ...	39.6≀	43.7≀	39.6≀	38.9≀	37.2≀	35.5≀	34.6≀	34.4≀	34.6	38.5	43.7	46.5	47.6	48.3	46.5
15 ...	40.1	41.2	40.0	39.2	37.6	35.7	33.7	32.7	33.8	37.4	41.8	45.1	47.7	47.8	46.4
16 ...	41.0	40.7	39.6	39.4	38.6	37.6	33.7	31.8	31.7	34.3	39.8	43.8	46.5	47.0	45.6
17 ...	39.5	39.4	38.4≀	38.8≀	38.2≀	36.5≀	39.9≀	35.5≀	34.4≀	37.3	40.6	43.6	46.5	45.5	45.6
18 ...	39.5	39.8	39.8	39.5	38.9	35.8	34.6	34.6	35.4	37.5	42.6	45.7	46.5	45.5	44.8
19 ...	39.2≀	37.8≀	38.2≀	37.8≀	37.5	34.9	34.8	33.4	35.4	39.1	40.4	41.6	43.7	44.6	43.6
20 ...	40.5	40.0	39.5	39.1	38.5	37.5	36.5	35.7	36.4	38.1	41.5	45.4	46.8	45.5	44.1
21 ...	40.1	39.8	39.3	39.6	40.0≀	36.6≀	33.5≀	31.6≀	34.6	36.4	41.4	43.8	45.3	46.9	47.0
22 ...	39.6	39.5	39.5	39.2	38.0	36.5	35.4	34.3	35.3	36.8	40.2	42.2	44.9	45.5	44.7
23 ...	34.7≀	37.9≀	38.0≀	36.1≀	36.4≀	35.8≀	35.2≀	32.5≀	35.4	39.0	43.1	45.6	47.2	47.7	46.0
24 ...	34.5≀	35.5≀	50.3≀	42.5≀	35.5≀	35.5≀	35.1≀	34.5≀	36.3	38.6	45.2	45.5	46.6	46.1	44.8
25 ...	39.5≀	39.5≀	41.7≀	41.7≀	40.4≀	41.5≀	31.9≀	31.0≀	33.3≀	36.2	40.4	43.7	44.8	......	......
26 ...	34.8≀	35.5≀	40.5≀	32.7≀	43.6≀	38.3≀	38.8≀	35.9≀	41.8≀	40.7≀	41.1	42.7	44.7	45.8	44.7
27 ...	40.6	43.7≀	40.6≀	38.8	36.8	35.7	35.6	34.7	35.8	39.4	39.8	45.1	43.9≀	46.7≀	47.7≀
28 ...	38.4≀	44.6≀	44.0≀	38.7≀	36.7≀	38.3≀	32.8≀	37.7≀	......	......	......	45.3	46.5	46.4	44.7
29 ...	39.2≀	45.2≀	41.8≀	43.0≀	39.6≀	36.7≀	36.4≀	34.6	35.5	37.6	40.5	46.7	47.6	47.7	46.4
30 ...	44.8≀	39.7≀	37.8≀	46.9≀	39.0≀	36.5	35.5	34.1	35.2	39.2	44.7	47.9	47.8	47.3	45.7
31 ...	39.8≀	39.4≀	46.6≀	40.5≀	37.5≀	34.7≀	35.3≀	35.7	35.5	37.5	40.0	43.7	45.3	45.3	43.8
M'ns.	39.51	39.81	40.20	39.38	38.17	36.26	35.54	34.82	35.57	38.00	41.55	44.33	45.78	45.79	44.81

Declination, 3° + tabular values (minutes), west; Mount

1 ...	36.7≀	39.4≀	40.1≀	41.5≀	39.8≀	37.7≀	35.7≀	35.7≀	35.6	37.5≀	39.9	43.7	43.8	43.8	42.8
2 ...	40.8	40.5	40.4	40.7	39.2	36.9	35.9	36.6	37.1	40.2	41.4	43.0	44.7	44.0	43.6
3 ...	40.4	39.7	39.7	38.7	38.8	37.7	36.4	35.7≀	40.9	42.8≀	40.1≀	42.9	44.7≀	37.8≀	42.6≀
4 ...	36.7≀	37.2≀	36.4≀	39.0≀	37.1≀	35.9≀	35.6≀	37.4≀	36.5≀	38.1≀	39.6≀	41.5	41.6	41.7	42.4
5 ...	40.5	40.4	40.1	39.9	39.7	38.7	37.7	37.6	38.1	38.8	39.9	41.0	41.6	41.9	42.0
6 ...	40.5	39.8	39.7≀	40.2≀	39.8≀	36.6≀	36.0≀	35.9≀	38.4	39.7	42.1	45.4	45.8	43.8	42.1
7 ...	40.5	40.4	40.8	39.9	40.1	39.4	38.4	37.6≀	36.7≀	40.7≀	41.8	43.9	44.7	44.7	43.7
8 ...	39.2≀	39.8≀	38.8	39.7	38.8	37.9	37.5	38.3	39.7	41.7	44.0	46.7	47.6	44.9	44.7
9 ...	41.6	41.0	39.9	39.7	38.7	37.4	37.8	36.7	37.6	38.8	43.4	45.8	45.3	43.6	42.8
10 ...	......	......	......	......	......	......	......	......	35.6	36.2	40.5	45.1	46.9	45.7	44.5
11 ...	41.0	40.9	40.4	40.8	39.3	38.1	36.0	35.7	34.7	36.0	39.9	41.8	42.5	43.0	43.9
12 ...	40.7	40.5	40.4	40.0	39.0	37.7	35.7	34.8	35.9	39.3	41.5	45.0	47.0	47.3	46.5
13 . .	39.4	40.9	39.8	38.8	38.8	37.4	37.0	35.2	35.7	38.1	42.8	44.8	44.9	44.6	43.9
14 ...	39.5≀	41.7≀	42.1	44.7≀	39.0≀	37.0≀	35.7	36.7	38.3	39.6	41.7	43.9	46.7	47.5	45.9
15 ...	40.8	41.1	40.5	40.9	40.5	38.2	36.1	35.1	33.3	35.4	39.3	44.5	45.9	46.6	46.5
16 ...	39.4	42.1	41.6	41.0	39.9	38.2	36.8	36.9	37.6	38.8	42.4	43.8	44.1	43.9	43.9
17 ...	40.6	40.0	40.1	39.0	38.4	37.1	36.9	36.9	36.9	35.5	37.9	42.0	42.6	45.5	46.5
18 ...	38.8	39.0	38.5≀	41.0≀	36.8≀	36.6≀	36.9≀	36.3≀	37.9≀	37.0≀	42.8≀	44.8	44.5	44.6	44.5
19 ...	45.1≀	44.2≀	39.7≀	39.6≀	37.2≀	36.9≀	35.7≀	37.6≀	35.9≀	39.0≀	42.2	46.6	47.5	47.6	45.9
20 ...	38.6≀	41.6≀	41.1≀	40.9≀	40.1≀	37.9≀	38.2≀	38.9≀	38.7≀	38.8≀	41.0≀	42.8	44.9	44.9	45.8
21 ...	42.2	40.9	40.9	45.9≀	41.5≀	37.5≀	35.2	34.8	36.9	38.0	40.7	42.3	42.5	42.5	43.8
22 ...	40.9	40.4	40.4	39.6	39.1	38.2	37.5	36.6	37.1	38.0	40.5	41.7	44.3	44.6	44.0
23 ...	40.4	41.1	40.4	39.7	39.1	37.8	36.4	36.5	35.5	37.3	39.3	41.5	43.0	44.8	45.1
24 ...	39.5	39.9	40.4	39.5	38.3	36.0	33.3	32.1	32.2≀	34.3≀	40.2≀	43.4	44.5	47.1	46.2
25 ...	39.5	39.4	39.6≀	36.5≀	36.3≀	34.5≀	32.4≀	31.8	33.7	36.5	39.6	43.4	44.4	42.5	42.3
26 ...	40.9≀	39.6≀	41.2≀	38.2≀	40.5≀	32.3≀	32.4≀	32.1	34.5	36.6	42.5	45.2≀	45.4≀	47.1≀	45.5≀
27 ...	41.1≀	40.8≀	39.4	39.1	37.4	35.7	34.0	35.2	35.1	38.3	40.4	41.0	43.2	43.5	42.8
28 ...	40.6≀	41.1≀	41.7≀	41.1≀	41.0≀	38.7≀	35.4	35.6	35.5	36.6	41.4	43.5	44.5	44.4	44.4
29 ...	40.2	40.8	40.6	41.7≀	42.5≀	39.4≀	36.6≀	35.8≀	36.4≀	35.8≀	41.5≀	44.4	45.4	45.3	45.2
30 ...	40.4	40.4	39.7	40.1	39.8	38.5	37.8	35.7	36.4	38.1	42.3	43.4	46.2	45.4	45.2
M'ns.	40.22	40.50	40.15	40.24	39.16	37.31	36.10	35.87	36.48	38.12	41.07	43.63	44.69	44.49	44.30

Weather, Va., May, 1908. (75th meridian time.)

Hours.									Means.	Extremes.		Range.	Character.		Date.
16	17	18	19	20	21	22	23	24		Max.	Min.		A.M.	P.M.	
45.8≀	42.5≀	39.6≀	35.2≀	32.0≀	38.4≀	39.6≀	32.5≀	33.1≀	39.09	48.6≀	28.5≀	20.1	3	3	1
40.3≀	40.4	40.2	38.5≀	32.5≀	38.7	36.7	39.1	39.5	39.66	47.5≀	32.1≀	15.4	4	3	2
42.5	40.7	39.7	39.6≀	38.5≀	36.3≀	38.5≀	39.3≀	40.3≀	39.61	44.4	34.9≀	9.5	3	3	3
42.7	41.1	39.6	37.3≀	36.6≀	36.1≀	38.4≀	38.9≀	40.4≀	38.99	44.5	30.3≀	14.2	3	3	4
43.5	42.6	40.6	39.5≀	36.8≀	39.5	37.3≀	37.5≀	38.8≀	39.67	44.6	33.3≀	11.3	3	3	5
43.0	42.3	41.8	40.6	40.3	40.4	40.2	39.6	39.5	39.99	45.2	33.8	11.4	3	1	6
41.8	40.8	40.1	39.6	38.5	39.5	39.6	40.8	39.5	39.52	43.8	34.9	8.9	2	2	7
42.4	41.4	40.6	40.5	40.1	40.5	40.5	40.8	39.6	39.77	44.4	34.6≀	9.8	3	1	8
40.4	39.5	39.5	40.5	41.1	40.7	40.8	40.3	40.2	40.01	44.5	35.7	8.8	2	2	9
43.6≀	42.3≀	42.3≀	40.2≀	36.6≀	33.0≀	45.3≀	36.7≀	39.7≀	39.39	46.1	21.0≀	25.1	2	5	10
43.1	42.3	40.7≀	39.6≀	41.3≀	40.3≀	37.7≀	36.1≀	42.0≀	39.93	45.6	27.4≀	18.2	3	3	11
41.8	41.2	40.6	41.3≀	38.2≀	39.5≀	39.3≀	36.7≀	36.8≀	40.12	45.5	35.6	9.9	3	3	12
42.6	41.5	40.4	39.6≀	33.6≀	38.2≀	40.7≀	41.0≀	40.5≀	40.41	52.7≀	32.4≀	20.3	3	3	13
43.8	41.4	39.7	39.6	39.5	40.2	40.6	40.5	40.5	40.62	48.5	33.6≀	14.9	3	1	14
44.0	41.5	39.3	39.5	39.8	40.2	40.1	40.0	40.0	40.19	48.3	32.5	15.8	1	1	15
43.3	41.2	39.5	39.5	40.2	40.0	40.3	39.9	39.7	39.74	47.2	30.8	16.4	2	1	16
42.9	40.6	39.8	39.6	39.8	40.5	40.3	40.0	39.5	40.11	46.7	32.9≀	13.8	3	1	17
42.2	40.4	39.7	40.1	40.5	40.5	40.4	40.0	37.4≀	40.05	46.6	33.7	12.9	2	3	18
42.5	41.5	40.5	40.6	40.4	35.9≀	34.6≀	38.5	40.2	39.15	44.8	32.6	12.2	3	3	19
41.9	40.5	39.6	40.4	40.5	40.4	40.4	40.3	40.1	40.38	47.1	35.7	11.4	1	1	20
45.5	42.5	40.6	40.0	40.0	40.3	39.8	40.0	39.6	40.28	47.4	33.3≀	14.1	3	1	21
43.5	41.6	41.3	40.5	38.5	38.3≀	31.9≀	32.6≀	30.4≀	38.76	46.0	30.4≀	15.6	1	3	22
45.5	45.0≀	45.5≀	43.9≀	42.0≀	40.0≀	40.2≀	39.1≀	36.4≀	40.32	48.4	30.5≀	17.9	3	3	23
41.6	40.5	40.3≀	39.8≀	40.1≀	38.9≀	38.5≀	41.2≀	41.3≀	40.36	51.4≀	32.5≀	18.9	4	3	24
......	39.0≀	28.7≀	36.8≀	37.0≀	34.5≀	43.9≀	31.8≀	35.8≀	37.77	57.8≀	16.7≀	41.1	3	5	25
42.2	40.7	40.9	42.7	42.9	41.2	40.7	41.8	41.3	40.67	47.4≀	23.7≀	23.7	4	2	26
44.3≀	43.5≀	39.7	40.2	40.4	38.7	39.4	40.7≀	40.1≀	40.70	49.4≀	34.3	15.1	3	3	27
42.7	41.1	39.9	38.4≀	35.7≀	36.9≀	39.7≀	35.5≀	42.2≀	40.06	50.0≀	29.8≀	20.2	3	3	28
41.3	37.1	37.1≀	37.6≀	36.1≀	39.7≀	39.8≀	42.0≀	44.5≀	40.57	47.8	33.9	13.9	3	3	29
43.7	41.7≀	38.7≀	40.7≀	40.5≀	38.5≀	38.6≀	40.5≀	40.6≀	41.07	48.5	33.7	14.8	3	3	30
42.5	42.1≀	40.5	40.7	40.9	40.5	40.4	40.2≀	39.6≀	40.33	48.7≀	33.4	15.3	3	3	31
42.88	41.31	39.89	39.76	38.75	39.01	39.33	38.64	39.33	39.92	47.40	31.56	15.84	2.7	2.5	M'ns.

Weather, Va., June, 1908. (75th meridian time.)

16	17	18	19	20	21	22	23	24	Means.	Max.	Min.	Range.	A.M.	P.M.	Date.
41.7	41.8	40.6	40.7	41.4	41.2	41.4	41.3	41.0	40.18	44.3	34.7	9.6	3	1	1
43.5	42.4	42.0	41.6	41.5	41.4	41.0	40.8	40.4	40.82	45.1	35.5	9.6	2	1	2
45.2≀	41.6≀	40.8≀	41.6≀	41.8≀	41.4≀	40.1≀	39.7≀	39.9≀	40.46	45.8≀	35.4≀	10.4	3	3	3
42.2	41.7	41.4	40.8	40.5	40.6	40.6	40.7	40.5	39.40	42.7	33.8≀	8.9	3	2	4
41.7	41.2	41.1	40.9	41.0	40.9	40.7	40.7	40.7	40.28	42.5	36.8	5.7	2	2	5
40.5	39.7	39.5	40.0	39.8	38.7	40.5	40.6	40.5	40.19	46.6	33.7≀	12.9	3	2	6
42.6	40.8	40.5	40.4	40.0	39.6	37.7≀	38.8≀	39.6≀	40.55	44.9	35.9≀	9.0	3	3	7
43.4	41.9	40.8	40.7	40.7	40.7	41.4	41.7	40.8	41.31	47.7	37.5	10.2	3	1	8
41.6	40.7	39.9	39.6	39.7	41.0	40.7	40.9	......	40.62	46.5	36.5	10.0	2	1	9
43.9	42.4	40.9	40.8	40.2	41.6	40.9	40.9	41.0	......	47.2	......	......	1	1	10
43.7	42.1	41.1	40.8	40.9	40.9	40.9	40.9	40.9	40.24	44.0	34.8	9.2	2	1	11
45.2	43.8	43.0	41.9	41.0	40.2	40.5	41.1	41.1	41.21	47.7	34.6	13.1	2	2	12
42.1	40.9	40.5	40.6	40.8	40.9	41.5	39.7≀	35.8≀	40.18	44.9	34.9	10.0	2	3	13
43.5	41.8	40.1	40.1	40.3	40.6	40.5	40.7	38.9	41.10	47.9	35.1	12.8	3	2	14
45.7	43.0	40.3≀	37.6≀	39.1	38.0	37.9≀	37.6≀	39.1	40.12	47.3	32.7≀	14.6	2	3	15
42.7	40.9	40.2	39.9	40.0	39.9	35.8≀	38.8≀	40.7	40.39	44.3	34.8≀	9.5	2	3	16
46.0	45.2	45.5	46.4≀	42.6≀	41.4≀	40.6	38.0	37.5	40.80	46.9≀	34.9≀	12.0	2	3	17
44.6	44.1	40.0≀	42.0≀	40.9≀	38.9≀	40.6≀	39.8≀	41.0≀	40.50	45.0	33.4≀	11.6	3	3	18
45.8	42.9	42.4	41.3	37.5≀	36.1≀	33.1≀	40.4≀	42.4≀	40.94	47.6	31.6≀	16.0	3	3	19
43.6	42.1	42.0	40.6≀	40.9≀	41.8	41.1	39.7	40.1	41.09	46.0	36.9≀	9.1	3	3	20
43.9	43.8	41.6≀	40.4	39.6	39.1	40.2	40.1	40.0	40.58	46.6≀	34.2	12.4	3	3	21
44.2	42.4	40.8	38.6	39.4	39.7	39.7	40.0	40.6	40.35	44.8	35.8	9.0	2	1	22
43.6	41.4	40.9	40.4	40.5	40.6	41.1	40.5	40.4	40.30	45.2	35.3	9.9	2	1	23
43.4	41.9	41.2	40.9	40.5	40.6	40.6	40.4	40.0	39.85	47.4	31.2≀	16.2	3	2	24
41.5	40.2	39.6	38.4	38.4	37.5≀	38.1≀	36.3≀	38.7≀	38.38	44.6	31.4≀	13.2	3	3	25
42.5≀	39.6≀	37.2≀	36.5≀	39.2≀	35.9≀	38.4≀	39.4≀	40.1≀	39.37	47.4≀	31.0≀	16.4	3	3	26
42.4	40.4	39.7	39.9	40.4	39.7	38.7	39.3	40.4	39.50	46.4≀	33.5	12.9	3	2	27
43.1	41.4	40.3	40.2	40.4	40.6	40.4	40.4	39.0	40.43	45.2	34.4	10.8	3	1	28
43.5	42.1	40.5	40.1	39.9	38.3	39.5	40.1	39.6	40.61	45.5	33.8≀	11.7	3	2	29
43.6	40.4	40.4	40.1	38.4≀	40.5≀	37.4≀	39.6	40.4	40.40	46.4	33.5≀	12.9	2	3	30
43.36	41.79	40.83	40.46	40.23	39.94	39.72	39.96	40.04	40.38	45.81	34.40	11.42	2.5	2.1	M'ns.

UPPER AIR TEMPERATURES FOR APRIL, MAY, AND JUNE.

By the Aerial Section—W. R. Blair in charge.

The mean of the highest altitudes reached daily in these three months, 7,607 feet (2,319 meters), is about 1,500 feet (457 meters) lower than that for the three months previous, altho the April mean is 9,095 feet (2,772 meters). This is due to the much less active air currents that prevailed from just before the middle of May until the end of June. The average hourly surface wind velocity for April was 17.9 miles per hour (8.0 meters per second), for May 12.7 miles per hour (5.7 meters per second), and for June 10.0 miles per hour (4.5 meters per second). This is in accord with the variation in pressure shown by the station barograph, the mean weekly variation of which for the first six weeks of the period under consideration was 0.65 inch (16.5 millimeters), while for the second six weeks this mean was 0.36 inch (9.14 millimeters).

The decidedly prevailing northwest wind of April gradually gave place to more variable southeasterly winds during the months of May and June. On more than half the days from May 10 to June 30, inclusive, an area of high pressure could be found central over the Gulf or Atlantic coast States or immediately over Mount Weather. The south to southeast winds resulting from this pressure distribution seldom exceed 1,000 or 2,000 feet in depth, and are often too light to sustain the kites.

For the latter reason the use of captive balloons was begun late in May. Instead of the small rubber balloons used as captives last summer, spherical balloons made of varnished cotton cloth and having a capacity of 905 cubic feet (25.6 cubic meters) were procured for this purpose. During the months of May and June eight ascensions were made with these captive balloons, the mean of the highest altitudes obtained being 6,436 feet (1,962 meters). On account of the great amount of gas required only one balloon was used in each ascension.

The isothermal charts show at a glance that accompanying the more pronounced variation of the pressure and the more active wind circulation there is a much greater variation in the position from day to day of a given isotherm. The somewhat irregular succession of warm and of cold periods are not only more pronounced at the earth's surface but to as great heights above it as successive records have been obtained.

The lowest temperature recorded during the year ending June 30, 1908, was — 18.2° F., — 27.9° C. It was found on January 2, 1908, at an altitude of 16,917 feet (5,156 meters). Taking the temperature of 0° F., — 17.2° C., as often as it was recorded during this year, the following dates and altitudes are found:

Date.	Altitude.		Date.	Altitude.	
	Feet.	*Meters.*		*Feet.*	*Meters.*
1907.			1908.		
October 3	22,090	6,733	January 30	9,268	2,825
November 18	15,269	4,654	January 31	12,533	3,820
1908.			February 4	9,760	2,975
January 2	12,297	3,748	February 17	5,807	1,770
January 3	13,986	4,263	February 22	5,512	1,680
January 15	17,979	5,480	February 26	11,811	3,600
January 21	18,274	5,570	April 3	6,972	2,125
January 23	11,483	3,500	April 14	20,597	6,278

The variations of these altitudes from their mean, 12,910 feet (3,935 meters), are at times sharp and in the whole period quite large. The temperature in question occurs at lower altitudes in the late winter and early spring than at other times.

The highest flight during the three months, April, May, and June, was made on April 14, 1908. The altitude reached in this flight, 22,650 feet (6,904 meters), is but 460 feet (140 meters) less than in the flight of October 3, 1907, and is the second highest so far obtained by means of kites.

The equipment for kite flying at Mount Weather has been considerably increased during the past year, as has also been the number of assistants available. Five men (Messrs. Wood, Sherry, Ross, and Marks, besides the writer), are now giving full time to the work of getting records and reducing them. The number of kites has been increased to 25, and with the installation of a new kite reel designed to carry upward of 50,000 feet (15,000 meters) of wire, the field equipment will be fairly complete. This reel will be in use some time in July.

Valley substations have been established in both valleys about 1,000 feet, 305 meters, below Mount Weather. One station, Trapp, is 1½ miles (2½ kilometers) to the east; the other, Audley, is 7 miles (11 kilometers) to the northwest of Mount Weather. It is the purpose of these stations to furnish records for comparison with each other and with those of Mount Weather. They are at present equipped with thermographs and thermometers and with rain-gages. Observations are made daily at 8 a. m. The Trapp substation has been in operation during June, and from the data Mr. Sherry has worked up the hourly temperatures at Trapp, also the hourly differences between Trapp and

Mount Weather. The data thus reduced promises to be of considerable interest. However, the following table gives only the mean hourly temperatures at Mount Weather, and the corresponding differences between Mount Weather and Trapp. It shows the greater daily range of temperature in the valley. The discussion of other phenomena, inversions of temperature, etc., will be postponed until further data upon them have been accumulated.

Mean hourly temperatures for June.

Hour.	Trapp.		Mount Weath.r.		Difference.		Hour.	Trapp.		Mount Weather.		Difference.	
a. m.	°*F.*	°*C.*	°*F.*	°*C.*	°*F.*	°*C.*	*p. m.*	°*F.*	°*C.*	°*F.*	°*C.*	°*F.*	°*C.*
1..........	64.9	18.3	63.6	17.6	1.3	0.7	1	76.0	24.4	70.9	21.6	5.1	2.8
2..........	64.4	18.0	63.0	17.2	1.4	0.8	2..........	76.7	24.8	71.5	21.9	5.1	2.8
3	63.9	17.7	62.4	16.9	1.5	0.8	3..........	76.3	24.6	72.2	22.3	4.1	2.3
4..........	63.6	17.6	62.1	16.7	1.5	0.8	4..........	76.0	24.4	71.8	22.1	4.2	2.3
5..........	63.3	17.4	61.3	16.3	2.0	1.1	5..........	75.4	24.1	71.5	21.9	4.0	2.2
6..........	64.3	17.9	61.4	16.3	2.9	1.6	6..........	73.7	23.2	70.7	21.5	3.0	1.7
7..........	65.9	18.8	62.0	16.7	3.9	2.2	7..........	70.7	21.5	69.1	20.6	1.6	0.9
8..........	68.3	20.2	63.5	17.5	4.8	2.7	8..........	69.0	20.6	67.1	19.5	1.8	1.0
9..........	70.1	21.2	64.4	18.0	5.7	3.2	9..........	67.8	19.9	66.7	19.3	1.1	0.6
10..........	72.0	22.2	66.5	19.2	5.6	3.1	10..........	67.5	19.7	66.0	18.9	1.5	0.8
11	73.5	23.1	68.1	20.1	5.4	3.0	11..........	66.2	19.0	65.3	18.5	0.9	0.5
12..........	74.8	23.8	69.2	20.7	5.6	3.1	12..........	65.6	18.7	64.3	17.9	1.2	0.7
Means for the 24 hours..............................								69.6	20.9	66.4	19.1	3.1	1.7

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m., 1,725 ft.						At different heights above sea.						
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. April 1:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
8:52 a. m.	43.3	6.3	94	se.	9	4.0	1,725	526	43.3	6.3	94	se.	9	4.0
9:01 a. m.	43.7	6.5	95	se.	11	4.9	2,517	767	39.2	4.0	....	ese.	......	......
1:22 p. m.	42.2	5.7	91	se.	14	6.3	3,782	1,153	39.4	4.1	....	ssw.	......	......
2:08 p. m.	42.0	5.6	95	se.	15	6.7	4,947	1,508	39.0	3.9	....	sw.	......	......
2:20 p. m.	42.2	5.7	94	se.	16	7.2	6,608	2,014	37.8	3.3	....	sw.	......	......
2:34 p. m.	42.6	5.9	90	se.	15	6.7	9,072	2,765	36.7	2.6	....	sw.	......	......
2:56 p. m.	42.4	5.8	94	se.	16	7.2	12,074	3,680	29.3	− 1.5	....	w.	......	......
3:41 p. m.	42.8	6.0	93	se.	15	6.7	15,303	4,666	19.2	− 7.1	....	w.	......	......
4:37 p. m.	42.4	5.8	95	se.	17	7.6	17,839	5,437	6.8	−14.0	....	w.	......	......
5:55 p. m.	42.4	5.8	95	se.	18	8.0	15,927	4,854	13.6	−10.2	....	w.	......	......
7:28 p. m.	41.3	5.2	90	se.	17	7.6	13,246	4,037	20.8	− 6.2	....	wsw.	......	......
8:26 p. m.	41.5	5.3	100	se.	19	8.5	8,923	2,720	36.1	2.3	....	sw.	......	......
8:50 p. m.	41.4	5.1	100	se.	22	9.8	6,619	2,017	48.9	9.4	....	sw.	......	......
9:23 p. m.	41.2	5.1	100	se.	22	9.8	5,476	1,669	49.8	9.9	....	sw.	......	......
9:51 p. m.	40.6	4.8	100	se.	21	9.4	3,212	976	37.2	2.9	....	s.	......	......
10:25 p. m.	40.2	4.6	100	se.	24	10.8	1,725	526	40.2	4.6	100	se.	24	10.8
April 2:														
7:28 a. m.	46.7	8.2	76	nw.	16	7.2	1,725	526	46.7	8.2	76	nw.	16	7.2
7:38 a. m.	47.0	8.3	73	nw.	15	6.7	2,921	890	43.5	6.4	....	w.	......	......
7:47 a. m.	48.0	8.9	71	nw.	14	6.3	3,833	1,168	40.6	4.8	....	wnw.	......	......
8:22 a. m.	48.0	8.9	42	nw.	27	12.1	5,162	1,573	35.2	1.8	....	wnw.	......	......
8:33 a. m.	48.0	8.9	34	nw.	28	12.5	6,359	1,938	39.2	4.0	....	wnw.	......	......
9:33 a. m	49.6	9.8	33	nw.	30	13.4	5,007	1,526	36.3	2.4	....	wnw.	......	......
10:03 a. m.	50.5	10.3	26	nw.	33	14.8	3,944	1,202	38.1	3.4	....	wnw.	......	......
10:25 a. m.	51.5	10.8	28	nw.	38	17.0	2,741	835	44.8	7.1	....	wnw.	......	......
10:38 a. m.	52.0	11.1	28	nw.	36	16.1	1,725	526	52.0	11.1	28	nw.	36	16.1
2d flight.														
11:46 a. m.	54.6	12.6	28	nw.	40	18.3	1,725	526	54.6	12.6	28	nw.	40	18.3
11:55 a. m.	53.5	11.9	28	nw.	40	18.3	2,645	806	46.4	8.0	....	wnw.	......	......
12:04 p. m.	52.2	11.2	29	nw.	38	17.0	3,604	1,099	41.4	5.2	....	wnw.	......	......
12:33 p. m.	54.8	12.7	28	w.	30	13.4	5,564	1,696	32.7	0.4	....	wnw.	......	......
1:05 p. m.	55.0	12.8	27	nw.	39	17.4	7,258	2,212	27.5	− 2.5	....	nw.	......	......
2:10 p. m.	54.0	12.2	24	nw.	48	21.5	1,725	526	54.0	12.2	24	nw.	48	21.5

April 1, 1908.—Nine kites were used; lifting surface, 569 sq. ft. (52.8 sq. m.). Wire out, 36,500 ft. (11,125 m.) at the maximum altitude.

Light rain and light fog prevailed at the beginning. Rain ended 9:06 a. m. Dense fog began 9:23 and ended 10:34 a. m. Light rain began 12:25 and ended 2:31 p. m. Light rain began 6:36 and dense fog began 7:28 p. m. and continued during the remainder of the flight.

Pressure was low over the upper Mississippi Valley and high over Ontario and Florida. Precipitation was general over the northern districts.

April 2, 1908.—First flight: Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 11,000 ft. (3,353 m.) at maximum altitude.

Second flight: Three kites were used; lifting surface, 145 sq. ft. (13.5 sq. m.). Wire out, 11,000 ft. (3,353 m.) at maximum altitude.

From 7 to 9:30 a. m. the sky was nearly overcast with A.-Cu., moving from the west, and from 9:30 a. m. to 2:10 p. m. it was partly covered with Ci.,A.-Cu., and occasionally St.-Cu., all moving from the west. A solar halo was observed from 9:14 to 9:54 a. m.

Pressure was high over the Missouri Valley and low over Ontario and Quebec. Rain occurred in northeastern districts.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.					Miles	Met's							Miles	Met's
April 3:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
1:30 p. m.	32.6	0.3	43	nw.	32	14.3	1,725	526	32.6	0.3	43	nw.	32	14.3
1:34 p. m.	31.0	− 0.6	43	nw.	32	14.3	3,049	929	23.9	− 4.5	....	wnw.	......	......
1:49 p. m.	30.7	− 0.7	42	nw.	26	11.6	4,044	1,233	16.5	− 8.6	....	wnw.	......	......
2:10 p. m.	30.7	− 0.7	39	nw.	30	13.4	6,443	1,964	3.2	−16.0	....	wnw.	......	......
3:04 p. m.	32.0	0.0	43	nw.	30	13.4	8,045	2,452	− 3.1	−19.5	....	w.	......	......
3:48 p. m.	31.0	− 0.6	39	nw.	30	13.4	9,250	2,819	− 9.4	−23.0	....	w.	......	......
3:51 p. m.	31.0	− 0.6	39	nw.	30	13.4	9,250	2,819	− 0.6	−18.1	....	w.	......	......
4:20 p. m.	30.9	− 0.6	40	nw.	32	14.3	11,417	3,480	− 4.9	−20.5	....	w.	......	......
4:58 p. m.	30.0	− 1.1	42	nw.	30	13.4	9,787	2,983	12.2	−11.0	....	wnw.	......	......
6:05 p. m.	29.0	− 1.7	45	nw.	29	13.0	7,991	2,436	14.0	−10.0	....	wnw.	......	......
6:57 p. m.	28.3	− 2.1	58	nw.	24	10.7	6,448	1,966	16.5	− 8.6	....	wnw.	......	......
7:07 p. m.	28.3	− 2.1	58	nw.	24	10.7	4,010	1,222	21.4	− 5.9	....	wnw.	......	......
7:12 p. m.	28.6	− 1.9	58	nw.	29	13.0	2,855	870	26.8	− 2.9	....	wnw.	......	......
7:19 p. m.	28.3	− 2.1	63	nw.	28	12.5	1,725	526	28.3	− 2.1	63	nw.	28	12.5
April 4:														
9:34 a. m.	32.8	0.4	52	nw.	30	13.4	1,725	526	32.8	0.4	52	nw.	30	13.4
9:39 a. m.	34.0	1.1	46	nw.	27	12.1	2,888	880	25.9	− 3.4	....	wnw.	......	......
9:52 a. m.	33.0	0.6	50	nw.	26	11.6	4,488	1,368	17.8	− 7.9	....	wnw.	......	......
10:06 a. m.	33.0	0.6	44	nw.	23	10.3	6,202	1,890	12.4	−10.9	....	nw.	......	......
11:11 a. m.	37.0	2.8	43	nw.	28	12.5	7,343	2,238	18.7	− 7.4	....	nw.	......	......
12:18 p. m.	39.8	4.3	38	nw.	36	16.1	9,683	2,951	18.7	− 7.4	....	nw.	......	......
12:46 p. m.	41.0	5.0	33	nw.	24	10.7	8,107	2,471	10.6	−11.9	....	nw.	......	......
1:00 p. m.	41.6	5.3	28	nw.	24	10.7	6,444	1,964	14.4	− 9.8	....	nw.	......	......
1:10 p. m.	41.5	5.3	28	nw.	28	12.5	4,708	1,435	23.7	− 4.6	....	nw.	......	......
1:35 p. m.	42.0	5.6	28	nw.	24	10.7	2,742	836	34.0	1.1	....	nw.	......	......
1:44 p. m.	42.5	5.8	28	nw.	25	11.2	1,725	526	42.5	5.8	28	nw.	25	11.2

April 3, 1908.—Five kites were used; lifting surface, 340 sq. ft. (31.5 sq. m.). Wire out, 30,000 ft. (9,144 m.) at the maximum altitude.

About 7/10 St.-Cu. were visible, moving from the west until 6 p. m. and from the west-northwest during the remainder of the flight. The head kite past into rapidly forming clouds at 3:48 and again at 4:58 p. m.

At 8 a. m. a low was central over New Brunswick and a high over the Gulf States.

April 4, 1908.—Five kites were used; lifting surface, 340 sq. ft. (31.5 sq. m.). Wire out, 25,000 ft. (7,620 m.); at maximum altitude, 21,700 ft. (6,614 m.).

The sky was about half covered with St.-Cu., moving from the northwest, until 10:45 a. m., when the amount decreased, leaving only a few clouds visible after 12:30 p. m.

High pressure, central over eastern Tennessee, covered the eastern half of the country. Pressure was low over Nova Scotia.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. / 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.	*° F.*	*° C.*	*%*		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	*° F.*	*° C.*	*%*		*Miles p. h.*	*Met's p. s.*
April 6:														
7:32 a. m.	48.2	9.0	76	nw.	13	5.8	1,725	526	48.2	9.0	76	nw.	13	5.8
7:45 a. m.	48.8	9.3	74	nw.	12	5.4	2,905	885	42.4	5.8	....	nw.	......	......
8:04 a. m.	50.0	10.0	67	nw.	12	5.4	4,174	1,272	36.9	2.9	....	nw.	......	......
8:18 a. m.	50.0	10.0	68	nw.	14	6.3	5,854	1,784	29.5	− 1.4	....	nw.	......	......
8:42 a. m.	50.0	10.0	71	nw.	15	6.7	6,364	1,940	42.8	6.0	....	nw.	......	......
8:50 a. m.	50.5	10.3	70	nw.	18	8.0	7,571	2,308	40.3	4.6	....	nw.	......	......
11:55 a. m.	52.2	11.2	57	nw.	17	7.6	7,117	2,169	42.1	5.7	....	nw.	......	......
11:13 a. m.	52.5	11.4	56	nw.	12	5.4	6,166	1,879	36.5	2.5	....	nw.	......	......
11:20 a. m.	54.8	12.4	54	nw.	12	5.4	4,455	1,358	38.3	3.5	....	nw.	......	......
11:30 a. m.	54.0	12.2	54	nw.	16	7.2	2,667	813	46.9	8.3	....	nw.	......	......
11:35 a. m.	54.1	12.3	54	nw.	16	7.2	1,725	526	54.1	12.3	54	nw.	16	7.2
April 7:														
4:50 p. m.	70.0	21.1	33	sse.	9	4.0	1,725	526	70.0	21.1	33	sse.	9	4.0
5:22 p. m.	69.5	20.8	35	se.	8	3.6	3,266	996	61.1	16.1	....	s.	......	......
5:37 p. m.	68.0	20.0	35	se.	7	3.1	4,057	1,237	57.0	13.9	....	s.	......	......
5:50 p. m.	67.8	19.9	36	se.	7	3.1	5,140	1,567	52.5	11.4	....	sw.	......	......
6:07 p. m.	67.0	19.4	39	se.	8	3.6	7,419	2,261	41.9	5.5	....	w.	......	......
6:20 p. m.	66.0	18.9	41	se.	7	3.1	8,772	2,764	39.0	3.9	....	w.	......	......
7:00 p. m.	66.0	18.9	40	se.	8	3.6	10,756	3,278	27.1	− 2.7	....	w.	......	......
7:12 p. m.	65.7	18.7	41	se.	8	3.6	8,855	2,699	36.3	2.4	....	w.	......	......
7:23 p. m.	65.4	18.6	41	se.	7	3.1	7,250	2,210	42.4	5.8	....	sw.	......	......
7:38 p. m.	65.5	18.6	42	se.	8	3.6	4,961	1,512	51.8	11.0	....	sw.	......	......
7:48 p. m.	65.8	18.5	41	se.	9	4.0	3,358	1,024	59.7	15.4	....	s.	......	......
7:57 p. m.	66.0	18.9	39	se.	9	4.0	1,725	526	66.0	18.9	39	se.	9	4.0
April 8:														
1:24 p. m.	62.5	16.9	87	sw.	18	8.0	1,725	526	62.5	16.9	87	sw.	18	8.0
1:32 p. m.	61.8	16.6	90	sw.	15	6.7	2,889	881	63.1	17.3	....	w.	......	......
1:44 p. m.	61.8	16.3	93	sw.	18	8.0	4,014	1,224	58.1	14.5	....	w.	......	......
1:55 p. m.	61.0	16.1	94	sw.	18	8.0	5,233	1,595	54.5	12.5	....	w.	......	......
2:08 p. m.	62.3	16.8	90	sw.	18	8.0	6,238	1,901	50.9	10.5	....	w.	......	......
2:50 p. m.	65.5	18.6	82	sw.	18	8.0	7,606	2,418	45.3	7.4	....	w.	......	......
3:20 p. m.	67.3	19.6	76	sw.	17	7.6	5,978	1,822	50.5	10.3	....	w.	......	......
3:41 p. m.	68.3	20.2	69	sw.	18	8.0	4,939	1,505	54.7	12.6	....	w.	......	......
3:57 p. m.	71.0	21.7	56	w.	22	9.8	4,007	1,221	59.4	15.2	....	w.	......	......
4:09 p. m.	71.0	21.7	54	w.	21	9.4	2,820	860	65.5	18.6	....	w.	......	......
4:13 p. m	70.8	21.6	54	w.	22	9.8	1,725	526	70.8	21.6	54	w.	22	9.8

April 6, 1908.—Five kites were used; lifting surface, 346 sq. ft. (32 sq. m.). Wire out, 14,300 ft. (4,359 m.); at maximum altitude, 8,000 ft. (2,438 m.).

Partly cloudy to cloudy weather prevailed during the flight. Clouds were mostly St.-Cu., moving from the northwest. Occasionally from 1/10 to 3/10 Ci. and A.-Cu. could be seen above the St.-Cu. and moving in the same direction. St.-Cu. past frequently under the leading kite between 8:27 and 11:14 a. m. at an altitude of about 5,800 ft. (1,768 m.).

Pressure was high over Kentucky and Florida and low over the lower St. Lawrence and north of Lake Superior.

April 7, 1908.—Five kites were used; lifting surface, 351 sq. ft. (32.5 sq. m.). Wire out, 15,000 ft. (4,572 m.); at maximum altitude, 13,000 ft. (3,962 m.).

From 8/10 to 9/10 Ci. were visible moving from the west.

At 8 a. m. a low was central over the lower St. Lawrence Valley and a high over Virginia and North Carolina.

April 8, 1908.—Three kites were used; lifting surface, 145 sq. ft. (13.5 sq. m.). Wire out, 15,500 ft. (4,724 m.) at maximum altitude.

The sky was overcast during the entire flight; 2/10 A.-St. and 8/10 St. at the beginning; 4/10 A.-St., 3/10 A.-Cu., and 3/10 St. at 3:41 p. m., and 3/10 A.-St. and 7/10 St. at 4:15 p. m.

At 8 a. m. an area of low pressure was central over southeastern Michigan and pressure was high over New Brunswick. There were general rains over the central and eastern portions of the country.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. April 9:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1:16 p. m.	47.9	8.8	48	nw.	20	8.9	1,725	526	47.9	8.8	48	nw.	20	8.9
1:25 p. m.	48.3	9.1	48	nw.	24	10.7	2,665	812	41.0	5.0	....	wnw.	......	......
1:37 p. m.	49.1	9.5	46	nw.	25	11.2	3,962	1,208	35.2	1.8	....	wnw.	......	......
1:59 p. m.	49.7	9.8	42	nw.	21	9.4	5,393	1,644	43.9	6.6	....	nw.	......	......
2:10 p. m.	50.0	10.0	42	nw.	21	9.4	7,818	2,388	39.2	4.0	....	nw.	......	......
2:26 p. m.	50.8	10.4	41	nw.	18	8.0	10,125	3,066	33.3	0.7	....	nw.	......	......
2:57 p. m.	52.0	11.1	43	nw.	20	8.9	12,782	3,896	23.5	− 4.7	....	nw.	......	......
3:57 p. m.	52.0	11.1	41	nw.	16	7.2	15,602	4,755	15.1	− 9.4	....	wnw.	......	......
4:35 p. m.	52.7	11.5	38	nw.	18	5.8	13,882	4,231	19.4	− 7.0	....	wnw.	......	......
5:02 p. m.	51.2	10.7	40	n.	18	5.8	12,339	3,761	24.4	− 4.2	....	nw.	......	......
5:19 p. m.	51.5	10.8	40	nw.	6	2.7	10,633	3,241	32.0	0.0	....	nw.	......	......
5:35 p. m.	51.0	10.6	41	nw.	10	4.5	7,749	2,362	37.8	3.2	....	nw.	......	......
5:50 p. m.	51.0	10.6	40	n.	10	4.5	6,036	1,840	40.5	4.7	....	wnw.	......	......
5:54 p. m.	51.0	10.6	40	n.	7	3.1	5,444	1,660	38.7	3.7	....	wnw.	......	......
6:01 p. m.	51.0	10.6	40	n.	8	3.6	4,010	1,222	42.8	6.0	....	wnw.	......	......
6:09 p. m.	49.2	9.6	46	nw.	8	3.6	2,765	843	46.2	7.9	...	nw.	......	......
6:16 p. m.	49.0	9.4	45	nw.	7	3.1	1,725	526	49.0	9.4	45	nw.	7	3.1
April 10:														
7:14 a. m.	43.8	6.6	68	s.	16	7.2	1,725	526	43.8	6.6	68	s.	16	7.2
7:19 a. m.	40.0	6.7	67	s.	17	7.6	2,898	883	42.8	6.0	....	ssw.	......	......
7:32 a. m.	40.0	6.7	68	s.	17	7.6	4,509	1,374	46.2	7.9	....	sw.	......	......
7:40 a. m.	39.8	4.3	68	s.	18	8.0	5,222	1,592	46.4	8.0	...	sw.	......	......
8:02 a. m.	44.8	7.1	65	s.	19	8.5	5,959	1,816	43.2	6.2	....	w.	......	......
8:23 a. m.	44.0	6.7	71	se.	20	8.9	6,619	2,017	41.0	5.0	....	w.	......	......
8:37 a. m	44.0	6.7	71	s.	20	8.9	5,290	1,612	44.4	6.9	....	w.	......	......
8:48 a. m.	44.0	6.7	69	s.	22	9.8	4,418	1,345	46.0	7.8	....	sw.	......	......
8:55 a. m.	44.0	6.7	73	s.	19	8.5	2,930	893	38.3	3.5	....	s.	......	......
9:06 a. m.	43.0	6.1	76	s.	17	7.6	1,725	526	43.0	6.1	76	s.	17	7.6
April 11:														
4:31 p. m	51.3	10.7	24	nw.	46	20.6	1,725	526	51.3	10.7	24	nw.	46	20.6
4:36 p. m.	51.7	10.9	26	nw.	45	20.1	3,018	918	41.5	5.3	....	wnw.	......	......
4:45 p. m.	51.0	10.6	26	nw.	48	21.5	3,627	1,106	37.2	2.9	....	wnw.	......	......
5:06 p. m.	50.1	10.1	23	nw.	46	20.6	6,189	1,886	24.1	− 4.4	....	wnw.	......	......
5:29 p. m.	49.4	9.7	27	nw.	46	20.6	4,910	1,497	29.1	− 1.6	....	wnw.	......	......
5:52 p. m.	49.0	9.4	26	nw.	51	22.8	3,630	1,106	35.6	2.0	....	wnw.	......	......
6:00 p. m.	48.8	9.3	26	nw.	54	24.1	3,260	994	38.1	3.4	....	wnw.	......	......
7:33 p. m	44.2	6.8	48	nw.	40	17.9	1,725	526	44.2	6.8	48	nw.	40	17.9

April 9, 1908.—Five kites were used; lifting surface, 340 sq. ft. (31.5 sq. m.). Wire out, 30,000 ft. (9,144 m.); at maximum altitude, 29,500 ft. (8,992 m.).

From 2/10 to 7/10 Ci. and Ci.-St. were observed moving from the west. Solar halos were observed at 12:15 and 5 p. m.

At 8 a. m. pressure was high over Ohio and Indiana. A low of considerable energy was central off the Nova Scotia coast and a moderate depression was central over North Carolina.

April 10, 1908. - Two kites were used; lifting surface, 136 sq. ft. (12.6 sq. m.). Wire out, 9,000 ft. (2,743 m.) at maximum altitude.

Ten St. moving from the west were visible until 8:11 a. m. and 10 N. moving from the west during the remainder of the flight.

A low was central over Lake Superior and a high over the middle Atlantic coast. An extensive rain area moving eastward enveloped the station during the latter part of the flight.

April 11, 1908.—Two kites were used: lifting surface, 98 sq. ft. (9.1 sq. m.). Wire out, 13,500 ft. (4,115 m.) at the maximum altitude.

About 1/10 St.-Cu. moving from the northwest was visible during the flight.

A marked depression was central north of the St. Lawrence at 8 a. m., and high pressure was central over Nebraska.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
1908. April 13:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:24 a. m.	54.5	12.5	26	nw.	30	13.4	1,725	526	54.5	12.5	26	nw.	30	13.4
7:29 a. m.	54.8	12.7	25	nw.	30	13.4	2,921	890	48.6	9.2	....	wnw.	......	......
7:50 a. m.	55.2	12.9	25	nw.	29	13.0	3,968	1,210	44.6	7.0	....	wnw.	......	......
7:58 a. m.	55.8	13.2	26	nw.	33	14.8	5,069	1,545	45.1	7.3	....	wnw.	......	......
8:11 a. m.	56.0	13.3	26	nw.	32	14.5	6,069	1,850	43.5	6.4	....	wnw.	......	......
8:37 a. m.	57.0	13.9	27	nw.	24	10.7	8,193	2,497	43.3	6.3	....	wnw.	......	......
9:09 a. m.	58.5	14.7	21	nw.	27	12.1	6,254	1,906	44.1	6.7	....	wnw.	......	......
9:38 a. m.	59.6	15.3	21	nw.	30	13.4	5,073	1,546	43.0	6.1	....	wnw.	......	......
9:55 a. m.	61.0	16.1	20	nw.	24	10.7	4,102	1,250	45.5	7.5	....	wnw.	......	......
10:05 a. m.	60.6	15.9	20	nw.	26	11.6	2,838	865	51.8	11.0	....	w.	......	......
10:09 a. m.	60.7	15.9	20	nw.	27	12.1	1,725	526	60.7	15.9	20	nw.	27	12.1
April 14:														
7:22 a. m.	36.4	2.4	58	se.	16	7.2	1,725	526	36.4	2.4	58	se.	16	7.2
10:55 a. m.	43.4	6.3	46	se.	15	6.7	2,641	805	36.3	2.4	....	s.	......	......
11:26 a. m.	45.0	7.2	46	se.	16	7.2	5,049	1,539	45.0	7.2	....	s.	......	......
12:25 p. m.	47.4	8.6	32	se.	17	7.6	7,862	2,396	38.7	3.7	....	sw.	......	......
1:00 p. m.	49.8	9.9	34	se.	16	7.2	9,818	2,993	32.7	0.4	....	w.	......	......
2:09 p. m.	53.2	11.8	27	se.	16	7.2	14,084	4,293	18.3	— 7.6	....	w.	......	......
2:53 p. m.	53.3	11.8	25	se.	18	8.0	18,727	5,708	7.3	—13.7	....	w.	......	......
4:02 p. m.	53.0	11.7	33	se.	16	7.2	22.650	6,904	— 7.2	—21.8	....	w.	......	......
4:32 p. m	55.0	12.8	29	se.	16	7.2	20,110	6,130	3.4	—15.9	....	w.	......	......
5:05 p. m.	53.8	12.1	34	se.	17	7.6	16,114	4,912	18.7	— 7.4	....	w.	......	......
5:42 p. m.	52.0	11.1	40	se.	15	6.7	11.437	3,486	31.3	— 0.4	....	wsw.	......	......
5:53 p. m.	52.0	11.1	40	se.	15	6.7	9,196	2,803	34.9	1.6	....	wsw.	......	......
6:10 p. m.	49.0	9.4	54	se.	17	7.6	7,480	2,280	40.5	4.7	....	sw.	......	......
6:35 p. m.	48.0	8.9	56	se.	17	7.6	5,206	1,587	47.7	8.7	....	ssw.	......	......
6:52 p. m.	47.0	8.3	60	se.	15	6.7	2,904	885	43.2	6.2	...	s.	......	......
7:02 p. m	46.5	8.1	60	se.	14	6.3	1,725	526	46.5	8.1	60	se.	14	6.3
April 15:														
7:18 a. m.	46.0	7.8	100	sw.	17	7.6	1,725	526	46.0	7.8	100	sw.	17	7.6
7:22 a. m.	46.0	7.8	100	s.	17	7.6	2,950	899	52.7	11.5	....	ssw.	......	......
7:35 a. m.	46.0	7.8	100	sw.	17	7.6	4,549	1,387	47.5	8.6	....	sw.	......	......
7:46 a. m.	45.9	7.7	100	s.	16	7.2	5,917	1,804	44.4	6.9	....	ssw.	......	......
8:09 a. m.	46.5	8.9	100	sw.	20	8.9	7,461	2,274	38.5	3.6	....	ssw.	......	......
8:20 a. m.	46.0	7.8	100	s.	17	7.6	3,212	970	54.5	12.5	....	ssw.	......	......
9:45 a. m.	47.0	8.3	100	s.	16	7.2	1,725	526	47.0	8.3	100	s.	16	7.2

April 13, 1908.—Two kites were used; lifting surface, 136 sq. ft. (12.6 sq. m.). Wire out, 15,000 ft. (4,572 m.) at the maximum altitude.

Except for a few upper clouds near the horizon the sky was cloudless.

Pressure was high over North Carolina and over Lake Superior, and low over Newfoundland.

April 14, 1908.—Nine kites were used; lifting surface, 623 sq. ft. (57.7 sq. m.). Wire out, 37.000 ft. (11,278 m.); at maximum altitude, 35,000 ft. (10,668 m.).

Ci. moving from the west were visble; a few from 6:58 to 10:55 a. m., 3/10 to 1.22 p. m., 5/10 to 2:53 p. m. and from 6/10 to 8/10 during the remainder of the flight.

A high was central over the north Atlantic coast and low over Manitoba.

April 15, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 14,000 ft. (4,328 m.); at maximum altitude, 12,000 ft. (3,658 m.).

Light rain fell during the entire flight. Fog, light at the beginning, became dense at 7:46 a. m., and so continued during the remainder of the flight.

Pressure was high over eastern North Carolina and low over the lower St. Lawrence. Rain was general over the southeastern portion of the country.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. April 16:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:46 a. m.	30.5	— 0.8	62	nw.	27	12.1	1,725	526	30.5	— 0.8	62	nw.	27	12.1
7:54 a. m.	31.5	— 0.3	64	n.	24	10.7	2,774	846	26.1	— 3.3	....	n.	......	......
8:02 a. m.	31.7	— 0.2	65	n.	27	12.1	3,757	1,145	37.4	3.0	....	nne.	......	......
8:24 a. m.	32.0	0.0	62	nw.	25	11.2	4,364	1,330	41.0	5.0	....	nne.	......	......
8:38 a. m.	32.6	0.3	58	nw.	27	12.1	3,858	1,176	37.8	3.2	....	nne.	......	......
8:43 a. m.	32.8	0.4	58	nw.	28	12.5	2,838	865	26.6	— 3.0	....	n.	......	......
8:51 a. m.	33.3	0.7	58	n.	29	13.0	1,725	526	33.3	0.7	58	n.	29	13.0
2d flight.														
9:44 a. m.	35.0	1.7	57	n.	22	9.8	1,725	526	35.0	1.7	57	n.	22	9.8
9:56 a. m.	35.6	2.0	50	n.	24	10.7	3,016	919	26.6	— 3.0	....	nne.	......	......
10:17 a. m.	36.0	2.2	50	n.	21	9.4	4,586	1,398	37.8	3.2	....	ne.	......	......
10:33 a. m.	37.2	2.9	48	n.	20	8.9	5,711	1,741	35.8	2.1	....	nne.	......	......
11:46 a. m.	39.5	4.2	42	n.	16	7.2	7,954	2,424	30.9	— 0.6	....	n.	......	......
12:18 p. m.	39.7	4.3	45	n.	13	5.8	10,169	3,100	32.2	0.1	....	nnw.	......	....
12:43 p. m.	40.8	4.9	43	nw.	13	5.8	8,208	2,502	28.6	— 1.9	....	n.	......	......
12:54 p. m.	41.0	5.0	42	nw.	15	6.7	6,962	2,122	31.3	— 0.4	....	n.	......	......
1:03 p. m.	41.4	5.2	44	n.	12	5.4	5,440	1,658	35.6	2.0	....	nne.	......	......
1:20 p. m.	42.8	6.0	49	n.	10	4.5	4,330	1,320	28.4	— 2.0	....	nne.	......	......
1:34 p. m.	44.0	6.7	44	n.	10	4.5	1,725	526	44.0	6.7	44	n.	10	4.5
April 17:														
7:24 a. m.	32.9	0.5	56	se.	10	4.5	1,725	526	32.9	0.5	56	se.	10	4.5
7:36 a. m.	33.0	0.6	58	se.	9	4.0	2,625	800	28.8	— 1.8	....	s.	......	......
11:00 a. m.	42.0	5.6	51	se.	14	6.3	5,097	1,554	32.4	0.2	....	ssw.	......	......
11:17 a. m.	42.3	5.7	52	se.	13	5.8	5,472	1,666	33.8	1.0	....	ssw.	......	......
12:13 p. m.	45.0	7.2	46	s.	12	5.4	7,220	2,201	28.6	— 1.9	....	wsw.	......	......
2:28 p. m.	47.8	8.8	45	se.	11	4.9	7,971	2,430	33.4	0.8	....	w.	......	......
3:16 p. m.	50.0	10.0	39	se.	11	4.9	5,749	1,752	38.8	3.8	....	wsw.	......	......
3:59 p. m.	50.0	10.0	39	se.	11	4.9	2,664	812	44.6	7.0	....	sse.	......	......
4:01 p. m.	50.8	10.4	39	se.	11	4.9	1,725	526	50.8	10.4	39	se.	11	4.9

April 16, 1908.—First flight: Two kites were used; lifting surface, 116 sq. ft. (10.8 sq. m.). Wire out, 7,000 ft. (2,134 m.); at maximum altitude, 6,700 ft. (2,042 m.).

Second flight: Five kites were used; lifting surface, 340 sq. ft. (31 5 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude, 17,000 ft. (5,182 m.).

At 7 a. m. 6/10 Ci.-St. were observed moving from the west. Cloudiness decreased gradually until 1:30 p. m., at which time the sky was cloudless.

An extensive area of high pressure central over the upper Lakes overlay districts east of the Rocky Mountains. A low of moderate intensity was over the Atlantic east of North Carolina.

April 17, 1908.—Six kites were used; lifting surface, 414 sq. ft. (38.3 sq. m.). Wire out, 16,000 ft. (4,877 m.) at maximum altitude.

A few St. moving from the south were visible until 10:25 a. m. Ci. moving from the west were visible during the remainder of the flight, gradually increasing in amount to 6/10 at 12:36 p. m., and diminishing to 1/10 at the close. A halo was visible from 1:00 to 3:49 p. m.

A high was central over the north Atlantic coast and a low over western Nebraska and South Dakota.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. April 18:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
10:47 a. m	50.0	10.0	81	s.	12	5.4	1,725	526	50.0	10.0	81	s.	12	5.4
10:58 a. m.	50.2	10.1	79	s.	15	6.7	2,794	852	49.1	9.5	....	ssw.	......	......
11:19 a. m.	51.0	10.6	76	sw.	16	7.2	4,391	1,338	50.5	10.3	....	wsw.	......	......
11:36 a. m.	51.5	10.8	77	s.	17	7.6	5,403	1,647	41.8	8.2	....	wsw.	......	......
11:51 a. m.	51.4	10.8	78	s.	15	6.7	7,137	2,175	38.3	3.5	....	wsw.	......	......
12:15 p. m.	51.0	10.6	77	s.	16	7.2	10,112	3,082	24.6	— 4.1	....	wsw.	......	......
12:30 p. m.	51.0	10.6	80	s.	12	5.4	8,687	2,648	28.9	— 1.7	....	wsw.	......	......
12:49 p. m.	50.4	10.2	84	s.	12	5.4	6,902	2,104	33.1	0.6	....	sw.	......	......
1:03 p. m.	49.0	9.4	92	sw.	15	6.7	1,725	526	49.0	9.4	92	sw.	15	6.7
April 20:														
7:36 a. m.	51.0	10.6	63	sw.	11	4.9	1,725	526	51.0	10.6	63	sw.	11	4.9
7:47 a. m.	50.8	10.4	61	sw.	11	4.9	2,838	865	49.6	9.8	....	wsw.	......	......
7:50 a. m.	51.0	10.6	61	sw.	12	5.4	3,156	962	53.6	12.0	....	w.	......	......
8:10 a. m.	51.8	11.0	59	sw.	14	6.3	5,062	1,543	47.7	8.7	....	wnw.	......	......
8:24 a. m.	53.8	12.1	54	sw.	16	7.2	6,297	1,919	42.8	6.0	....	wnw.	......	......
8:37 a. m.	55.6	13.1	45	sw.	16	7.2	4,863	1,482	49.5	9.7	....	w.	......	......
8:56 a. m.	57.2	14.0	41	sw.	18	8.0	3,460	1,055	54.7	12.6	....	w.	......	......
9:04 a. m.	57.9	14.4	42	sw.	18	8.0	3,262	994	52.5	11.4	....	w.	......	......
9:17 a. m.	57.0	13.9	49	sw.	17	7.6	1,725	526	57.0	13.9	49	sw.	17	7.6
April 21:														
7:21 a. m.	36.8	2.7	58	nw.	17	7.6	1,725	526	36.8	2.7	58	nw.	17	7.6
7:31 a. m.	37.5	3.1	51	nw.	17	7.6	2,765	843	30.9	— 0.6	....	nw.	......	......
7:49 a. m.	37.6	3.1	48	nw.	20	8.9	3,835	1,169	27.0	— 2.8	....	nw.	......	......
8:06 a. m.	37.8	2.9	47	nw.	17	7.6	5,511	1,680	21.6	— 5.8	....	nw.	......	......
8:14 a. m.	37.6	3.1	46	nw.	19	8.5	6,553	1,997	24.3	— 4.3	....	nw.	......	......
8:30 a. m.	38.8	3.8	47	nw.	19	8.5	7,794	2,376	20.7	— 6.3	....	nw.	......	......
10:17 a. m.	43.0	6.1	25	nw.	18	8.0	9,063	2,762	21.7	— 5.7	....	nw.	......	......
1:34 p. m.	51.0	10.6	16	nw.	27	12.1	7,888	2,404	21.2	— 6.0	....	nw.	......	......
2:44 p. m.	52.7	11.5	19	nw.	30	13.4	5,627	1,715	29.1	— 1.6	....	nw.	......	......
3:03 p. m.	53.0	11.7	19	nw.	31	13.9	3,926	1,197	39.9	4.4	....	nw.	......	......
7:40 p. m.	47.0	8.3	30	nw.	24	10.7	1,725	526	47.0	8.3	30	nw.	24	10.7

April 18, 1908.—Five kites were used; lifting surface, 346 sq. ft. (32.0 sq. m.). Wire out, 15,000 ft. (4,572 m.); at maximum altitude, 14,100 ft. (4,298 m.).

The sky was overcast, with St. moving from the west-southwest. Light rain fell after 11:20 a. m. The head kite was in clouds from 11:48 to 11:51 a. m. and from 12:05 to 12:22 p. m.

Low pressure was central over Lake Michigan, with a secondary depression over the Gulf of St. Lawrence. Pressure was highest off the North Carolina coast.

April 20, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 10,000 ft. (2,048 m.) at maximum altitude.

The sky was cloudless until 9 a. m. when a few Ci.-St. were visible near the horizon.

Pressure was low over eastern districts with the center of disturbance north of Lake Ontario, and relatively high over Minnesota and Colorado.

April 21, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 12,000 ft. (3,658 m.) at the maximum altitude.

A few St.-Cu. moving from the west were visible until 12.50 p. m. The sky was cloudless during the remainder of the flight.

A low was central over the lower St. Lawrence Valley and a high over Lake Michigan.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*
April 22:														
2:45 p. m.	69.3	20.7	21	sw.	11	4.9	1,725	526	69.3	20.7	21	sw.	11	4.9
3:08 p. m.	70.0	21.1	20	s.	10	4.5	2,936	895	63.3	17.4	....	ssw.	......	.....
3:25 p. m.	70.0	21.1	20	sw.	12	5.4	4,181	1,274	57.7	14.3	...	wsw.	......	.....
4:27 p. m.	69.7	20.9	21	s.	11	4.9	5,082	1,549	58.6	14.8	....	nw.	......	.....
5:32 p. m.	68.1	20.1	24	s.	13	5.8	5,668	1,728	54.7	12.6	....	nw.	......	.....
5:50 p. m.	68.0	20.0	24	sw.	16	7.2	4,064	1,239	58.8	14.9	....	w.	......	.....
5:57 p. m.	67.5	19.7	24	sw.	14	6.3	2,855	870	62.4	16.9	....	ssw.	......	.....
6:05 p. m.	67.5	19.7	24	sw.	16	7.2	1,725	526	67.5	19.7	24	sw.	16	7.2
April 23:														
5:06 p. m.	76.0	24.4	31	se.	8	3.6	1,725	526	76.0	24.4	31	se.	8	3.6
5:20 p. m.	75.5	24.2	32	se.	6	2.7	2,707	825	72.0	22.2	...	sse.	......	.....
6:14 p. m.	73.5	23.1	34	s.	7	3.1	3,886	1,184	63.0	17.2	....	ssw.	......	.....
6:28 p. m.	73.0	22.8	33	s.	8	3.6	5,433	1,656	55.8	13.2	....	sw.	......	.....
6:34 p. m.	72.6	22.6	33	sw.	9	4.0	3,610	1,100	64.0	17.8	....	ssw.	......	.....
6:41 p. m.	72.3	22.4	34	sw.	10	4.5	2,921	890	67.6	19.8	....	ssw.	......	.....
6:50 p. m.	72.1	22.3	37	sw.	12	5.4	1,725	526	72.1	22.3	37	sw.	12	5.4
April 24:														
2:32 p. m.	79.0	26.1	37	se.	11	4.9	1,725	526	79.0	26.1	37	se.	11	4.9
2:39 p. m.	78.0	21.6	37	se.	12	5.4	2,607	795	73.4	23.0	....	sse.	......	.....
2:56 p. m.	78.5	25.8	37	se.	11	4.9	3,775	1,151	68.0	20.0	....	sse.	......	.....
3:27 p. m.	79.4	26.3	37	se.	11	4.9	5,149	1,570	61.2	16.2	....	sse.	......	.....
3:57 p. m.	79.0	26.1	37	se.	11	4.9	6,445	1,964	53.6	12.0	....	s.	......	.....
6:07 p. m.	74.0	23.3	49	se.	13	5.8	4,104	1,251	64.8	18.2	....	sse.	......	.....
6:18 p. m.	72.9	22.7	49	se.	12	5.4	2,954	900	68.0	20.0	..	sse.	......	.....
6:28 p. m.	73.0	22.8	49	se.	12	5.4	1,725	526	73.0	22.8	49	se.	12	5.4

April 22, 1908.—Five kites were used; lifting surface, 346 sq. ft. (32.0 sq. m.). Wire out, 15,000 ft. (4,572 m.); at maximum altitude, 8,800 ft. (2,682 m.).

8/10 Ci.-St. from the northwest prevailed from the beginning of the flight until 5:17 p.m., and 10/10 Ci. from the northwest from 5:17 p. m. until the end. A solar halo was visible during the entire flight.

Pressure was high over eastern Virginia and low over northern Michigan.

April 23, 1908.—Two kites were used; lifting surface, 189 sq. ft. (17.5 sq. m.). Wire out, 6,000 ft. (1,829 m.); at maximum altitude, 4,500 ft. (1,372 m.).

A few A.-Cu. were observed at 5 p. m. moving from the west. After 6 p. m. St.-Cu. appeared moving from the west-southwest and increased rapidly in amount. Distant thunder was heard at 6:15 p. m. Light rain began at 6:43 p. m.

At 8 a. m. low pressure and unsettled weather prevailed generally thruout the country, with the principal center of disturbance over southeast Wyoming, and with secondary ones off the South Carolina coast and over the Gulf of St. Lawrence. Pressure was relatively high over northeast Alabama and north of Lake Superior.

April 24, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 10,000 feet (3,048 m.) at the maximum altitude.

Clouds moving from the west were observed as follows: 2 Ci.-St. and 1 Cu. to 3 p. m.; 4 St.-Cu. to 3:30 p. m.; 1 Ci. and a few St.-Cu. to 4:30 p. m., and 2 Ci.-Cu. and 1 St.-Cu. during the remainder of the flight.

A high was central over the lower St. Lawrence Valley and a low over Kansas and Nebraska.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. April 25:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:34 a. m.	59.1	15.1	92	se.	8	3.6	1,725	526	59.1	15.1	92	se.	8	3.6
7:45 a. m.	59.8	15.4	90	se.	9	4.0	2,983	909	63.0	17.2	....	sw.	......	......
7:54 a. m.	60.0	15.6	89	se.	9	4.0	4,321	1,317	59.2	15.1	....	sw.	......	......
8:10 a. m.	59.9	15.5	90	se.	9	4.0	5,207	1,587	56.8	13.8	....	ssw.	......	......
8:18 a. m.	60.0	15.6	89	se.	8	3.6	1,725	526	60.0	15.6	89	se.	8	3.6
2d flight:														
1:56 p. m.	59.8	15.4	90	s.	14	6.3	1,725	526	59.8	15.4	90	s.	14	6.3
2:03 p. m.	59.8	15.4	90	s.	15	6.7	2,764	842	55.6	13.1	....	ssw.	......	......
2:13 p. m.	60.0	15.6	89	s.	14	6.3	4,012	1,223	54.1	12.3	....	ssw.	......	......
2:25 p. m.	60.0	15.6	89	s.	12	5.4	4,945	1,507	50.9	10.5	....	sw.	......	......
2:34 p. m.	60.2	15.7	88	s.	13	5.8	5,363	1,635	47.7	8.7	....	sw.	......	......
2:48 p. m.	60.8	16.0	86	s.	15	6.7	6,687	2,038	41.4	5.2	....	sw.	......	......
3:02 p. m.	60.1	15.6	89	sw.	15	6.7	5,166	1,575	45.1	7.3	....	sw.	......	......
3:08 p. m.	60.1	15.6	89	sw.	15	6.7	1,725	526	60.1	15.6	89	sw.	15	6.7
April 27:														
11:25 a. m.	74.9	23.8	57	sw.	12	5.4	1,725	526	74.9	23.8	57	sw.	12	5.4
11:36 a. m.	75.0	23.9	58	sw.	12	5.4	2,764	842	70.3	21.3	....	s.	......	......
12:26 p. m.	76.2	24.6	55	sw.	13	5.8	4,079	1,243	63.9	17.7	....	ssw.	......	......
12:40 p. m.	76.4	24.7	54	sw.	14	6.3	5,094	1,553	59.0	15.0	....	ssw.	......	......
12:50 p. m.	77.2	25.1	53	sw.	12	5.4	6,487	1,977	52.5	11.4	....	sw.	......	......
1:05 p. m.	77.4	25.2	52	s.	13	5.8	7,412	2,259	51.4	10.8	....	wsw.	......	......
2:04 p. m.	77.5	25.3	54	s.	13	5.8	5,692	1,735	57.6	14.2	....	sw.	......	......
2:10 p. m.	76.8	24.9	53	s.	16	7.2	3,985	1,214	64.8	18.2	....	ssw.	......	......
2:20 p. m.	77.0	25.0	52	s.	16	7.2	2,873	867	69.8	21.0	....	s.	......	......
2:30 p. m.	77.7	25.4	54	s.	12	5.4	1,725	526	77.7	25.4	54	s.	12	5.4

April 25, 1908.—First flight: Two kites were used; lifting surface, 142 sq. ft. (13.1 sq. m.). Wire out, 7,400 ft. (2,256 m.) at the maximum altitude.

Second flight: Two kites were used; lifting surface, 98 sq. ft. (9.1 sq. m.). Wire out, 12,000 ft. (3,657 m.); at maximum altitude, 11,000 ft. (3,353 m.).

During both flights the sky was overcast with St., moving from the southwest. Light rain fell from 1:41 to 2:10 p. m., and after 2:50 p. m. Distant thunder was heard in the southwest at 1:50 p. m. The head kite was in clouds, except for short intervals, after 2:31 p. m.

Very low pressure, central over Wisconsin, covered the country east of the Rocky Mountains. At 8 a. m. rain was falling from the Mississippi Valley eastward, and thunder-storms had occurred thruout the South Atlantic States and the upper Mississippi Valley.

April 27, 1908.—Three kites were used; lifting surface, 212 sq. ft. (19.4 sq. m.). Wire out, 11,500 ft. (3,505 m.); at maximum altitude, 10,200 ft. (3,109 m.).

The sky was overcast during most of the flight, with about 9/10 upper clouds, Ci.-St. predominating, and 1/10 Cu., all moving from the west. Solar halos were observed at intervals from 7:45 a. m. to 12 m. At 12:57 p. m. a detached cloud past under the leading kite at an altitude of 6,850 ft. (2,088 m.).

A low of marked intensity was central over Wisconsin and a secondary disturbance was over Georgia and South Carolina. Pressure was relatively high over the western plateaus and over northeastern Canada. Rains and snows occurred in the central valleys and the Lake region and heavy showers in the Southeastern States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.					Miles	Met's							Miles	Met's
April 28:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
7:26 a. m.	50.4	10.2	68	nw.	17	7.6	1,725	526	50.4	10.2	68	nw.	17	7.6
7:35 a. m.	50.4	10.2	68	nw.	18	8.0	2,622	799	46.6	8.1	....	nw.	......	......
8:38 a. m.	52.4	11.3	67	nw.	16	7.2	3,874	1,181	48.2	9.0	....	sw.	......	......
8:56 a. m.	53.4	11.9	66	nw.	14	6.3	7,032	2,143	33.8	1.0	....	sw.	......	......
9:09 a. m.	54.0	12.2	65	nw.	12	5.4	9,186	2,800	24.8	— 4.0	....	sw.	......	......
9:27 a. m.	55.3	12.9	60	nw.	13	5.8	10,750	3,277	22.2	— 6.0	....	sw.	......	......
9:51 a. m.	56.5	13.6	60	nw.	12	5.4	13,198	4,023	18.7	— 7.4	....	sw.	......	......
10:26 a. m.	58.4	14.7	54	nw.	14	6.3	10,145	3,092	23.0	— 5.0	...	sw.	......	......
10:36 a. m.	59.0	15.0	54	nw.	14	6.3	5,178	1,577	41.0	5.0	....	sw.	......	......
10:43 a. m.	59.0	15.0	54	w.	15	6.7	1,725	526	59.0	15.0	54	w.	15	6.7
April 29:														
7:55 a. m.	52.4	11.3	45	w.	13	5.8	1,725	526	52.4	11.3	45	w.	13	5.8
8:10 a. m.	52.5	11.4	46	w.	13	5.8	2,706	825	46.4	8.0	....	w.	......	......
8:50 a. m.	53.8	12.1	45	w.	15	6.7	3,527	1,075	40.3	4.6	....	w.	......	......
9:35 a. m.	54.0	12.2	44	w.	12	5.4	2,498	761	46.8	8.2	....	w.	......	......
9:56 a. m	55.0	12.8	47	nw.	12	5.4	1.725	526	55.0	12.8	47	nw.	12	5.4
April 30:														
1:46 p. m.	54.5	12.5	84	se.	13	5.8	1,725	526	54.5	12.5	84	se.	13	5.8
1:52 p.m.	54.0	12.2	82	se.	13	5.8	2,766	953	50.4	10.2	....	se.	......	......
1:57 p. m.	53.6	12.0	80	se.	12	5.4	3,890	1,083	46.0	7.8	....	se.	......	......
2:07 p.m.	53.2	11.8	86	se.	12	5.4	4,955	1,510	39.7	4.3	....	sse.	......	......
2:12 p. m.	53.0	11.7	86	se.	12	5.4	6,555	1.998	38.3	3.5	. .	s.	......	......
2:22 p. m.	52.8	11.3	90	se.	12	5.4	5,292	1,613	39.7	4.3	....	s.	......	......
2:35 p. m.	52.0	11.1	94	se.	11	4.9	4,265	1,300	40.6	4.8	....	sse.	......	......
2:41 p. m.	52.0	11.1	96	se	10	4.5	3,604	1,099	43.9	6.6	....	se.	......	......
2:54 p. m.	51.8	11.0	96	se.	11	4.9	2,735	834	49.3	9.6	....	se.	......	......
2:58 p. m.	52.0	11.1	97	se.	11	4.9	1,725	526	52.0	11.1	97	se.	11	4.9

April 28, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 19,900 ft. (6,066 m.) at the maximum altitude.

2/10 Ci., gradually diminishing to a few, were visible moving from the west until 8:12 a. m. From 1/10 to 3/10 St.-Cu., moving from the southwest, were visible thruout the flight.

Lows were central over Connecticut and northern Michigan and a high over the lower St. Lawrence Valley.

April 29, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 4,000 ft. (1,219 m.); at maximum altitude, 3,500 ft. (1,067 m.).

A few Cu. moving from the northwest were observed during the flight.

Pressure was high over Colorado and low over the lower St. Lawrence.

April 30, 1908.—Two kites were used; lifting surface, 136 sq. ft. (12.6 sq. m.). Wire out, 7,500 ft. (2,286 m.) at maximum altitude.

Rain prevailed thruout the flight During the ascent the clouds were moving from the south, and the leading kite entered the cloud base at an altitude of about 5,000 ft. (1,524 m.). Later the clouds were moving from the southeast and were somewhat lower. The leading kite emerged from the clouds in the descent at an altitude of about 2,700 ft. (823 m.). Light fog began at 3:07 p. m.

At 8 a. m. an energetic low was central over western North Carolina and high pressure prevailed over the western districts. Rains were general in Gulf and South Atlantic States and rain and snows in the Ohio Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. May 1:	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*	*Feet.*	*Meters.*	° *F.*	° *C.*	%		*Miles p. h.*	*Met's p. s.*
1:28 p. m.	45.8	7.7	34	nw.	24	10.7	1,725	526	45.8	7.7	34	nw.	24	10.7
1:37 p. m.	45.7	7.6	38	nw.	24	10.7	2,686	819	39.0	3.9	....	w.	......	......
1:49 p. m.	46.0	7.8	40	nw.	23	10.3	3,222	982	35.2	1.8	....	w.	......	......
2:03 p. m.	45.8	7.4	38	nw.	24	10.7	4,296	1,310	25.7	−3.5	....	w.	......	......
2:25 p. m.	47.3	8.5	39	nw.	30	13.4	5,362	1,635	18.5	−7.5	....	w.	......	......
2:55 p. m.	46.0	7.8	40	nw.	20	8.9	7,059	2,152	9.5	−12.5	....	w.	......	......
3:08 p. m.	47.0	8.3	30	nw.	25	11.2	5,029	1,533	19.8	−6.8	....	w.	......	......
3:23 p. m.	47.0	8.3	41	nw.	26	11.6	3,674	1,120	25.7	−3.5	....	w.	......	......
3:35 p. m.	47.0	8.3	40	nw.	21	9.4	2,773	845	38.1	3.4	....	w.	......	......
3:45 p. m.	48.6	9.2	39	nw.	20	8.9	1,725	526	48.6	9.2	39	nw.	20	8.9
May 2:														
7:06 a. m.	46.0	7.8	64	sw.	10	4.5	1,725	526	46.0	7.8	64	sw.	10	4.5
7:20 a. m.	46.2	7.9	63	sw.	10	4.5	3,023	921	42.6	5.9	....	w.	......	......
7:31 a. m.	47.8	8.8	57	sw.	15	6.7	4,477	1,365	36.9	2.7	....	wnw.	......	......
8:01 a. m.	48.7	9.3	55	sw.	15	6.7	6,617	2,017	28.8	−1.8	....	wnw.	......	......
8:20 a. m.	49.7	9.8	58	sw.	20	8.9	8,141	2,481	21.6	−5.8	....	wnw.	......	......
8:46 a. m.	50.8	10.4	51	sw.	18	8.0	8,683	2,647	16.5	−8.6	....	wnw.	......	......
8:57 a. m.	51.2	10.7	51	sw.	22	9.8	10,300	3,139	7.7	−13.5	....	wnw.	......	......
9:32 a. m.	54.1	12.3	52	sw.	13	5.8	10,537	3,212	9.3	−12.6	....	wnw.	......	......
10:15 a. m.	57.0	13.9	46	sw.	11	4.9	9,260	2,823	13.1	−10.5	....	wsw.	......	......
10:40 a. m.	57.0	13.9	46	sw.	14	6.3	7,494	2,284	23.8	−5.1	....	wsw.	......	......
10:49 a. m.	57.0	13.9	46	se.	13	5.8	6,687	2,038	27.5	−2.5	....	wsw.	......	......
11:17 a. m.	55.9	13.3	49	sw.	17	7.6	4,251	1,296	39.0	3.9	...	ssw.	......	......
11:25 a. m.	56.0	13.3	48	se.	14	6.3	3,073	937	48.7	9.3	....	ssw-	......	......
11:33 a. m.	55.0	12.8	47	sw.	19	8.5	1,725	526	55.0	12.8	47	sw.	19	8.5

RESULTS OF CAPTIVE BALLOON ASCENSION.

May 4:														
6:08 p. m.	40.0	4.4	100	nne.	5	2.2	1,725	526	40.0	4.4	100	nne.	5	2.2
6:11 p. m.	40.0	4.4	100	n.	5	2.2	4,411	1,344	49.6	9.8	...	w.	......	......
6:23 p. m.	40.0	4.4	100	n.	6	2.7	1,725	526	40.0	4.4	100	n.	6	2.7

May 1, 1908.—Four kites were used; lifting surface, 200 sq. ft. (18.6 sq. m.). Wire out, 12,000 ft. (3,658 m.); at maximum altitude, 10,000 ft. (3,048 m.).

From 6/10 to 9/10 St.-Cu. were visible moving from the west.

A low was central over the lower St. Lawrence Valley and a high over the Gulf States.

May 2, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 22,000 ft. (6,706 m.); at maximum altitude, 20,300 ft. (6,187 m.).

A few St.-Cu. moving from the west-southwest were visible until 9 a. m. Small amounts of Ci.-St. and Ci.-Cu. were present from 8:20 until 10 a. m. when they gave place to A.-Cu. that disappeared by 11 a. m. St.-Cu. increased from 4/10 at 10:30 to 7/10 at 11:20 a. m., and gave way to St. before the end of the flight. Clouds were moving from the west except where noted.

Low pressure was central over Lake Huron and high pressure over western Florida.

May 4, 1908.—One balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 2,780 ft. (847 m.).

Light rain and dense fog prevailed.

Pressure was high over the Lake region and low over Oklahoma and Kansas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
1908. May 5:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
4:19 p. m.	43.0	6.1	89	se.	11	4.9	1,725	526	43.0	6.1	89	se.	11	4.9
4:29 p. m.	43.0	6.1	89	se.	15	6.7	2,687	819	41.0	5.0	....	se.	......	......
4:39 p. m.	43.0	6.1	91	se.	15	6.7	3,129	954	37.8	3.2	....	se.	......	......
4:48 p. m.	43.0	6.1	91	se.	18	5.8	3,866	1,178	39.4	4.1	....	se.	......	......
5:40 p. m.	43.0	6.1	91	se.	11	4.9	3,264	995	39.4	4.1	....	se.	......	......
5:49 p. m.	43.0	6.1	91	se.	6	2.7	2,727	831	39.4	4.1	....	se.	......	......
5:55 p. m.	43.0	6.1	91	se.	6	2.7	1,725	526	43.0	6.1	91	se.	6	2.7
May 6:														
9:16 a. m.	40.3	4.6	100	se.	10	4.5	1,725	526	40.3	4.6	100	se.	10	4.5
9:44 a. m.	40.3	4.6	100	se.	12	5.4	2,983	909	42.3	5.7	....	se.	......	......
9:55 a. m.	41.0	5.0	100	se.	11	4.9	4,349	1,326	45.9	7.7	....	sse.	......	......
10:24 a. m.	41.0	5.0	100	se.	9	4.0	4,887	1,490	44.0	6.7	....	sse.	......	......
11:58 a. m.	42.0	5.6	100	se.	16	7.2	3,772	1,150	46.6	8.1	....	sse.	......	......
12:25 p. m.	42.5	5.8	100	se.	16	7.2	2,898	883	45.3	7.4	....	sse.	......	......
1:24 p. m.	43.6	6.4	100	se.	16	7.2	1,725	526	43.6	6.4	100	se.	16	7.2

RESULTS OF CAPTIVE BALLOON ASCENSION.

May 7:														
5:29 p. m.	48.7	9.3	100	nw.	5	2.2	1,725	526	48.7	9.3	100	nw.	5	2.2
5:31 p. m.	49.0	9.4	100	n.	5	2.2	4,729	1,442	48.9	9.4	....	wsw.	......	......
5:43 p. m.	48.8	9.3	100	nw.	6	2.7	3,388	1,033	47.7	8.7	....	wsw.	......	......
6:42 a. m.	48.0	8.9	100	nw.	13	5.8	1,725	526	48.0	8.9	100	nw.	13	5.8

May 5, 1908.—Two kites were used; lifting surface, 142 sq. ft. (13.1 sq. m.). Wire out, 5,500 ft. (1,676 m.) at the maximum altitude.

The sky was covered with St. moving from the southeast until 5:40 p. m. and with N. thereafter. Light rain fell from 5:40 p. m. until the end of the flight.

A high was central over southern Manitoba and a low over Oklahoma.

May 6, 1908.—Two kites were used; lifting surface, 136 sq. ft. (12.6 sq. m.). Wire out, 7,500 ft. (2,286 m.) at maximum altitude.

Light rain and dense fog prevailed during the entire flight.

Pressure was high over Maine and low over the lower Mississippi. Rain was general over the eastern half of the country.

May 7, 1908.—One balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 7,000 ft. (2,134 m.).

Dense fog prevailed.

At 8 a. m. an extensive and energetic area of low pressure was central over Indiana. Pressure was high over New Brunswick. Rains were quite general east of the Mississippi.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
May 8:														
1:04 p. m.	56.1	13.4	52	w.	18	8.0	1,725	526	56.1	13.4	52	w.	18	8.0
1:19 p. m.	56.0	13.3	45	w.	20	8.9	2,822	860	51.8	11.0	....	sw.	......	......
1:37 p. m.	56.0	13.3	45	w.	19	8.5	3,794	1,156	34.2	8.0	....	sw.	......	......
1:51 p. m.	56.4	13.6	44	w.	19	8.5	4,462	1,360	42.1	5.6	....	sw.	......	......
2:15 p. m.	54.0	12.2	48	w.	20	8.9	6,784	2,068	29.3	— 1.5	....	sw.	......	......
3:29 p. m.	54.0	12.2	49	w.	21	9.4	7,447	2,270	26.6	— 3.0	....	sw.	......	......
4:08 p. m.	56.0	13.3	50	w.	15	6.7	8,526	2,599	21.6	— 5.8	....	wsw.	......	......
4:34 p. m.	53.2	11.8	52	w.	14	6.3	10,497	3,200	17.8	— 7.9	....	wsw.	......	......
5:00 p. m.	53.0	11.7	55	w.	12	5.4	12,032	3,668	10.8	—11.8	...	wsw.	......	......
5:15 p. m.	52.5	11.4	55	w.	12	5.4	8,978	2,736	16.7	— 8.5	....	wsw.	......	......
5:25 p. m.	52.1	11.2	56	w.	12	5.4	7,581	2,311	23.4	— 4.8	....	sw.	......	......
5:40 p. m.	51.7	10.9	64	w.	18	8.0	6,053	1,845	28.6	— 1.9	....	sw.	......	......
5:46 p. m.	49.0	9.4	72	w.	16	7.2	4,692	1,430	35.2	1.8	....	sw.	......	......
5:55 p. m.	48.1	8.9	77	nw.	19	8.5	3,858	1,176	37.9	3.3	....	sw.	......	......
6:07 p. m	47.7	8.7	86	nw.	14	6.3	2,855	870	41.7	— 5.4	....	w.	......	......
6:13 p. m.	48.0	8.9	86	nw.	14	6.3	1,725	526	48.0	8.9	86	nw.	14	6.3
May 9:														
7:38 a. m.	43.9	6.6	80	nw.	16	7.2	1,725	526	43.9	6.6	80	nw.	16	7.2
7:46 a. m.	44.0	6.7	84	nw.	21	9.3	3,010	918	38.7	3.7	....	wnw.	......	......
8:06 a. m.	45.0	7.2	79	nw.	16	7.2	4,318	1,316	32.5	0.3	....	wnw.	......	......
8:19 a. m.	45.2	7.3	82	nw.	24	10.7	5,718	1,743	30.4	— 0.9	....	nw.	......	......
8:57 a. m.	47.7	8.7	78	nw.	29	13.0	6,606	2,013	28.4	— 2.0	....	nw.	......	......
9:22 a. m.	48.7	9.3	85	nw.	28	12.5	9,550	2,911	14.5	— 9.7	....	nw.	......	......
9:47 a. m.	49.0	9.4	67	nw.	23	10.3	9,864	3,006	21.9	— 5.6	....	nw.	......	......
10:11 a. m.	49.0	9.4	74	nw.	26	11.6	10,909	3,325	16.7	— 8.5	....	nw.	......	......
10:39 a. m.	48.7	9.3	70	w.	19	8.5	9,106	2,776	26.4	— 3.1	....	nw.	......	......
10:45 a. m.	48.3	9.1	72	w.	18	8.0	8,622	2,628	20.5	— 6.4	...	nw.	......	......
10:55 a. m.	47.8	8.8	78	w.	20	8.9	7,060	2,152	26.6	— 3.0	....	nw.	......	......
11:30 a. m.	47.7	8.7	70	w.	20	8.9	4,702	1,433	30.6	— 0.8	....	wnw.	......	......
11:43 a. m.	47.3	8.5	71	nw.	18	8.0	4,058	1,237	33.4	0.8	....	wnw.	......	......
11:54 a. m.	47.2	8.4	73	nw.	17	7.6	2,685	879	38.5	3.6	...	wnw.	......	......
11:59 a. m.	47.0	8.3	73	nw.	16	7.2	1,725	526	47.0	8.3	73	nw.	16	7.2

May 8, 1908.—Six kites were used; lifting surface, 414 sq. ft. (38.3 sq. m.). Wire out, 21,500 ft. (6,553 m.); at the maximum altitude 18,000 ft. (5,486 m.).

Clouds moving from the west were visible as follows: 4/10 Ci. and 5/10 St.-Cu. until 1:37 p. m., 2/10 Ci. and 6/10 St.-Cu. until 2:15 p. m., 8/10 St.-Cu. until 3:29 p. m., 1/10 Ci. and 3/10 St.-Cu. until 4:34 p. m., 9/10 St.-Cu. until 5:36 p. m., and 10 N. during the remainder of the flight. Light rain fell after 5:36 p. m.

A low was central over the lower Lakes and a high over eastern North Dakota and western Minnesota.

May 9, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 20,000 ft. (6,096 m.); at maximum altitude, 19,200 ft. (5,852 m.).

Until 8:15 a. m. the sky was covered, and until 9:25 a. m. partly covered with St.-Cu. and St. moving from the northwest. Just before 9 a. m. 2/10 A.-Cu., also from the northwest, were observed. After 9:30 a. m. the sky was practically overcast with St.-Cu., moving from the northwest until about 11 a. m., and from the west-northwest thereafter. Light rain began at 12:05 p. m. The head kite was hidden by clouds from 8:06 to 8:08 a. m., and from 9:25 to 11:30 a. m.

Low pressure was central over Maine and high pressure over the Missouri River Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. May 11:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
9:13 a. m.	62.5	16.9	40	w.	22	9.8	1,725	526	62.5	16.9	40	w.	22	9.8
9:20 a. m.	62.8	17.1	40	nw.	21	9.4	2,766	848	60.4	15.8	....	w.	......	......
9:37 a. m.	64.0	17.8	39	nw.	20	8.9	3,567	1,087	61.0	16.1	....	w.	......	......
10:16 a. m.	67.0	19.4	42	w.	20	8.9	5,119	1,560	54.5	12.5	....	wnw.	......	......
10:39 a. m.	67.0	19.4	42	w.	16	7.2	6,978	2,127	43.9	6.6	....	wnw.	......	......
11:28 a. m.	70.8	21.6	35	w.	12	5.4	9,506	2,898	30.0	− 1.1	....	wnw.	......	......
12:17 p. m.	72.2	22.3	33	sw.	14	6.3	11,868	3,617	23.0	− 5.0	....	wnw.	......	......
1:05 p. m.	74.0	23.3	34	sw.	11	4.9	9,726	2,964	30.9	− 0.6	....	w.	......	......
1:19 p. m.	74.0	23.3	34	w.	11	4.9	5,467	1,666	51.3	10.7	....	w.	......	......
1:30 p. m.	74.0	23.3	34	sw.	13	5.8	1,725	526	74.0	23.3	34	sw.	13	5.8
May 12:														
7:40 a. m.	71.2	21.8	37	sw.	19	8.5	1,725	526	71.2	21.8	37	sw.	19	8.5
7:46 a. m.	71.5	21.9	38	sw.	18	8.0	2,890	881	66.2	19.0	....	sw.	......	......
7:57 a. m.	71.9	22.2	39	sw.	19	8.5	3,997	1,218	59.0	15.0	....	sw.	......	......
8:06 a. m.	71.8	22.1	40	sw.	19	8.5	5,190	1,582	51.4	10.8	....	sw.	......	......
8:33 a. m.	71.8	22.1	41	sw.	16	7.2	7,240	2,207	40.1	4.5	....	wsw.	......	......
9:15 a. m.	71.9	22.2	41	sw.	16	7.2	8,105	2,471	41.9	5.5	....	w.	......	......
9:42 a. m.	73.8	23.2	41	sw.	17	7.6	7,463	2,275	42.4	5.8	....	w.	......	......
10:00 a. m.	74.0	23.3	40	sw.	13	5.8	5,733	1,748	49.1	9.5	....	wsw.	......	......
10:18 a. m.	74.0	23.3	40	sw.	19	8.5	4,486	1,367	54.0	12.2	....	wsw.	......	......
10:25 a. m.	75.0	23.9	40	sw.	15	6.7	3,514	1,071	62.6	17.0	....	wsw.	......	......
10:37 a. m	76.0	24.4	40	sw.	19	8.5	2,646	806	68.0	20.0	....	sw.	......	......
10:41 a. m.	75.6	24.2	40	sw.	18	8.0	1,725	526	75.6	24.2	40	sw.	18	8.0
May 13:														
7:35 a. m.	68.4	20.2	61	nw.	10	4.5	1,725	526	68.4	20.2	61	nw.	10	4.5
7:46 a. m.	69.5	20.8	60	nw.	11	4.9	2,782	848	67.5	19.7	....	wnw.	......	......
9:07 a. m.	72.0	22.2	57	nw.	11	4.9	3,681	1,122	63.3	17.4	....	wnw.	......	......
9:16 a. m.	71.7	22.1	58	nw.	8	3.6	2,859	872	66.9	19.4	....	wnw.	......	......
9:21 a. m.	71.4	21.9	54	nw.	8	3.6	1,725	526	71.4	21.9	54	nw.	8	3.6

May 11, 1908.—Five kites were used; lifting surface, 340 sq. ft. (31.5 sq. m.). Wire out, 20,100 ft. (6,126 m.) at maximum altitude.

Clouds were high Ci. moving from the west-northwest, and increased gradually in amount from a few at the beginning to 5/10 at the end of the flight. A solar halo was observed at 1:30 p. m.

Pressure was high over North Carolina and low over Kansas.

May 12, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 18,000 ft. (5,486 m.) at maximum altitude.

About 1/10 A.-Cu. moving from the west was visible until 8:30 a. m., and 1/10 St.-Cu. from the west thereafter. From 8:30 to 10:00 a. m. the upper kite was concealed by haze which was present from 8:25 a. m. to the end of the flight.

A low was central over northern Michigan and a high over Florida.

May 13, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 5,300 ft. (1,615 m.); at maximum altitude, 3,700 ft. (1,128 m.).

8/10 Ci.-St. moving from the west-northwest and a small standing St.-Cu. cloud over Loudoun Valley were observed at the beginning. The St.-Cu. had disappeared and the Ci.-St. diminished to a few at the end of the flight.

Pressure was high over the Southeastern States and low over northern Texas.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity	
1908.					Miles	Met's							Miles	Met's
May 14:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
7:16 a. m.	68.1	20.1	68	sw.	15	6.7	1,725	526	68.1	20.1	63	sw.	15	6.7
7:21 a. m.	68.7	20.4	61	w.	15	6.7	2,804	855	68.9	20.5	....	w.	......	......
7:40 a. m.	69.0	20.6	61	w.	16	7.2	4,057	1,237	63.0	17.2	....	w.	......	......
8:00 a. m.	70.6	21.4	58	w.	16	7.2	6,048	1,843	52.9	11.6	....	w.	......	......
8:15 a. m.	71.0	21.7	58	w.	14	6.3	7,330	2,234	49.8	9.6	....	w.	......	......
8:33 a. m.	71.3	21.8	57	w.	13	5.8	8,741	2,664	44.1	6.7	....	wsw.	......	......
9:10 a. m.	74.3	23.5	54	w.	13	5.8	7,906	2,410	47.1	8.4	....	wsw.	......	......
9:22 a. m.	75.5	24.2	50	w.	12	5.4	6,162	1,878	52.9	11.6	....	w.	......	......
9:30 a. m.	75.8	24.3	48	w.	12	5.4	5,186	1,584	56.1	13.4	....	w.	......	......
9:39 a. m.	75.8	24.3	47	w.	11	4.9	3,143	958	69.3	20.7	....	wsw.	......	......
9:50 a. m.	76.2	24.6	45	w.	12	5.4	1,725	526	76.2	24.6	45	w.	12	5.4
May 15:														
7:27 a. m.	46.0	7.8	100	e.	12	5.4	1,725	526	46.0	7.8	100	e.	12	5.4
8:21 a. m.	46.0	7.8	100	e.	14	6.3	2,857	871	49.5	9.7	....	se.	.....	......
9:15 a. m.	46.0	7.8	100	e.	12	5.4	1.725	526	46.0	7.8	100	e.	12	5.4
May 16:														
1:08 p. m.	56.0	13.3	94	se.	11	4.9	1,725	526	56.0	13.3	94	se.	11	4.9
1:50 p. m.	58.2	14.6	89	se.	10	4.5	2,710	826	65.1	18.4	....	ssw.	......	......
3:32 p. m.	61.0	16.1	88	se.	8	3.6	1,725	526	61.0	16.1	88	se.	8	3.6
May 18:														
7:37 a. m.	63.0	17.2	68	ne.	11	4.9	1,725	526	63.0	17.2	68	ne.	11	4.9
7:54 a. m.	63.8	17.7	68	ne.	12	5.4	2,802	854	57.7	14.3	....	ene.	......	......
8:13 a. m.	64.0	17.8	63	e.	14	6.3	2,925	892	60.1	15.6	....	ene.	......	......
9:39 a. m.	66.3	19.1	64	se.	13	5.8	3,565	1,087	58.3	14.6	....	ene.	......	......
9:42 a. m.	66.3	19.1	64	se.	13	5.8	3,077	938	61.5	16.4	....	ene.	......	......
9:44 a. m.	66.0	18.9	64	se.	14	6.3	2,589	789	60.1	15.6	....	ene.	......	......
9:47 a. m.	65.7	18.7	64	se.	14	6.3	1,725	526	65.7	18.7	64	se.	14	6.3

May 14, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq, m.) Wire out, 15,000 ft. (4,572 m.); at maximum altitude, 14,000 ft. (4, 267 m.).

At 7 a. m. 9/10 St.-Cu. were observed moving from the west. These had disappeared by 9 a.m., and from that time to the end of the flight the sky was from 2/10 to 4/10 covered by Ci.-Cu. moving from the west-southwest and A.-Cu. moving from the west.

Pressure was high off the Northern Carolina coast and low over Nebraska.

May 15, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out, 4,900 ft, (1,944 m.); at maximum altitude, 3,000 ft. (914 m.).

Dense fog prevailed during the entire flight. Light rain began at 8:36 a. m. and continued until the close of the flight.

A high was central over New England and southeastern Canada and a low over southern Virginia and North Carolina.

May 16, 1908.—One kite was used; lifting surface, 121 sq. ft. (11.2 sq. m.). Wire out, 2,600 ft. (792 m.); at the maximum altitude, 2,300 ft. (701 m.).

Light fog was present until 1:20 p. m. About 8/10 low St. moving from the south-southeast was visible during the flight; and 1/10 Ci.-Cu. moving from the west was observed at intervals after 1:55 p.m. The kite was in low clouds, except at intervals, from 1:13 to 3:20 p.m.

At 8 a. m. pressure was high from eastern North Carolina northward along the coast, and was relatively low over Lake Superior.

May 18, 1908.—Four kites were used; lifting surface, 278 sq. ft. (25.7 sq.m.). Wire out, 8,250 ft. (2,515 m.); at maximum altitude, 6,300 ft. (1,920 m.).

The sky was from 6/10 to 9/10 covered by Ci.-St. and Ci.-Cu. moving from the west. A solar halo was visible from 7:54 a. m. to 9:18 a. m.

Pressure was low over eastern Iowa, and high over Florida and Quebec.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. May 19.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
1,21 p. m.	63.0	17.2	100	se.	14	6.3	1,725	526	63.0	17.2	100	se.	14	6.3
1:33 p. m.	61.5	16.4	100	se.	11	4.9	2,912	888	57.2	14.0	....	se.	......	......
1:41 p. m.	61.9	16.6	100	se.	10	4.5	3,736	1,139	55.4	13.0	...	se.	......	......
1:45 p. m.	61.9	16.6	100	se.	10	4.5	1,725	526	61.9	16.6	100	se.	10	4.5

RESULTS OF CAPTIVE BALLOON ASCENSION.

Date and hour.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.
May 20.														
4:06 p. m	68.1	20.1	80	ne.	6	2.7	1,725	526	68.1	20.1	80	ne.	6	2,7
4:15 p. m.	69.0	20.6	75	e.	6	2.7	6,688	2,038	51.3	10.7	....	o	......	......
4:30 p. m.	68.8	20.4	73	ne.	6	2.7	5,304	1,617	53.8	12.1	....	o	......	......
4:40 p. m.	68.3	20.2	75	ne.	6	2.7	3,980	1,213	56.8	13.8	...	o	......	......
4:50 p. m.	68.3	20.2	75	ne.	6	2.7	3,264	995	59.2	15.1	....	ne.	......	......
5:04 p. m.	68.0	20.0	76	e.	5	2.2	2,568	783	63.0	17.2	....	ne.	......	......
5:10 p. m.	68.0	20.0	76	e.	5	2.2	1,725	526	68.0	20.0	76	e.	5	2.2

RESULTS OF KITE FLIGHTS.

Date and hour.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.
May 21.														
11:00 a. m.	61.6	16.4	100	se.	18	8.0	1,725	526	61.6	16.4	100	se.	18	8.0
11:19 a. m.	61.8	16.6	100	e.	18	8.0	2,889	881	58.6	14.8	....	e.	......	......
12:08 p. m.	62.0	16.7	100	e.	18	8.0	4,284	1,306	53.8	12.1	....	ese.	......	......
12:42 p. m.	62.0	16.7	100	e.	17	7.6	5,654	1,723	51.1	10.6	....	ese.	......	......
1:06 p. m.	62.4	16.9	100	se.	20	8.9	4,029	1,228	56.1	13.4	...	e.	......	......
1:42 p. m.	62.4	16.9	100	se.	20	8.9	2,477	755	59.4	15.2	....	e.	......	......
1:45 p. m.	62.4	16.9	100	se.	20	8.9	1,725	526	62.4	16.9	100	se.	20	8.9

May 19, 1908.—One kite was used; lifting surface, 68 sq. ft. (6.3 sq. m.). Wire out, 3,500 ft. (1,067 m.) at the maximum altitude.

Dense fog, accompnnied by light rains prevailed thruout the flight.

A high was central over the New England coast and a low over New England.

May 20, 1908.—One balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 5,000 ft. (1,676 m.).

3/10 A.-St. and 7/10 Cu. were observed at the beginning. The lower clouds, moving from the northeast, had gradually decreased to 2/10 Cu. and the higher clouds, with no apparent motion, had increased to 8/10 A.-St. by the end of the flight.

A low of considerable magnitude was central over South Dakota, and a secondary depression was central over North Carolina.

Pressure was relatively high off the coast of New England. Rain occurred during the preceding twenty-four hours over the eastern portion of the country.

May 21, 1908.—Three kites were used; lifting surface, 142 sq. ft. (13.2 sq. m.). Wire out, 10,000 ft. (3,048 m.) at maximum altitude.

Dense fog prevailed until 12;27 p. m., and light fog to the end of the flight. Light rain occurred from 11:43 a. m. to 11:54 a. m. and from 1:22 p. m. to 1:57 p. m.

Pressure was high over the Gulf of St. Lawrence, and a trough of low pressure extended from Montana to Texas, with a secondary disturbance over the Carolinas. Rains fell in Atlantic coast States.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
1908.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
May 22.														
1:32 p. m.	72.8	22.4	72	s.	8	3.6	1,725	526	72.8	22.4	72	s.	8	3.6
2:17 p. m.	73.0	22.8	78	s.	7	3.1	2,954	900	66.2	19.0	....	s.	......	......
2:37 p. m.	72.9	22.7	77	se.	9	4.0	1,725	526	72.9	22.7	77	se.	9	4.0

RESULTS OF CAPTIVE BALLOON ASCENSION.

Date and hour.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.
May 23.														
1:31 p. m.	75.4	24.1	66	nw.	4	1.8	1,725	526	75.4	24.1	66	nw.	4	1.8
1:37 p. m.	75.5	24.2	64	nw.	7	3.1	5,914	1,803	57.2	14.0	....	nnw.	......	......
1:48 p. m.	75.7	24.3	68	nw.	5	2.2	4,338	1,322	60.3	15.7	....	nnw.	......	......
2:03 p. m.	75.3	24.1	62	nw.	6	2.7	3,337	1,017	65.3	18.5	....	nnw.	......	......
2:12 p. m.	74.8	23.8	65	nw.	6	2.7	2,518	768	71.6	22.0	....	n.	......	......
2:18 p. m.	76.0	24.4	70	nw.	6	2.7	1,725	526	76.0	24.4	70	nw.	6	2.7

RESULTS OF KITE FLIGHTS.

Date and hour.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.
May 25:														
3:37 p. m.	76.5	24.7	74	se.	8	3.6	1,725	526	76.5	24.7	74	se.	8	3.6
3:58 p. m.	77.5	25.3	69	se.	10	4.5	2,766	843	72.9	22.7	....	se.	......	......
4:21 p. m.	75.7	24.3	80	se.	8	3.6	3,492	1,064	67.5	19.7	....	se.	......	......
4:30 p. m.	75.0	23.9	80	se.	8	3.6	4,207	1,282	63.7	17.6	....	se.	......	......
5:43 p. m.	72.2	22.3	80	s.	10	4.5	4,195	1,279	66.6	19.2	....	se.	......	......
6:14 p. m.	71.8	22.1	82	se.	8	3.6	2,874	876	68.5	20.3	....	sse.	......	......
6:19 p. m.	71.5	21.9	82	se.	10	4.5	1,725	526	71.5	21.9	82	se.	10	4.5

May 22, 1908.—One kite was used; lifting surface, 121 sq. ft. (11.2 sq. m.). Wire out, 2,000 ft. (610 m.); at maximum altitude, 1,500 ft. (457 m.).

About 1/10 A.-Cu. moving from the west, and 3/10 St. and Cu. from the south were visible during the flight.

A high was central over Nova Scotia and a low over the Red River of the North Valley.

May 23, 1908.—One balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 6,000 ft. (1,829 m.).

Ci.-St. and 1/10 or less Cu., moving from the north-northwest, nearly covered the sky during the flight.

High pressure was central east of New England, and pressure was relatively low north of Lake Ontario.

May 25, 1908.—Three kites were used; lifting surface, 257 sq. ft. (23.8 sq. m.). Wire out, 9,600 ft. (2,926 m.); at maximum altitude, 3,900 ft. (1,189 m.).

About 4/10 Cu. were observed at the beginning of the flight, moving from the southeast. These had increased to 8/10 by 4:30 p. m., after which time they diminished gradually to a few. A. St. appeared about 5 p. m, moving from the southwest, and increased to about 4/10. The leading kite entered a large Cu. at 4:21 p. m., the base of the cloud being at an altitude of 3,492 ft. (1,064 m.).

Pressure was high over New England and low over the upper Mississippi Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. May 26:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
6:58 a. m.	72.0	22.2	69	sw.	10	4.5	1,725	526	72.0	22.2	69	sw.	10	4.5
7:08 a. m.	72.0	22.2	69	sw.	11	4.9	3,024	922	68.0	20.0	....	wsw.	......	......
7:42 a. m.	73.2	22.9	69	sw.	12	5.4	4,817	1,468	61.5	16.4	....	w.	......	......
9:17 a. m.	75.9	24.4	74	s.	4	1.8	3,707	1,130	66.9	19.4	....	wsw.	......	......
9:30 a. m.	75.5	24.2	74	sw.	5	2.2	3,359	1,024	68.0	20.0	....	sw.	......	......
9:34 a. m.	75.7	24.3	74	sw.	5	2.2	1,725	526	75.7	24.3	74	sw.	5	2.2
2d flight.														
1:55 p. m.	77.1	25.1	67	s.	12	5.4	1,725	526	77.1	25.1	67	s.	12	5.4
2:02 p. m.	78.0	25.6	67	s.	12	5.4	2,978	908	70.7	21.5	....	ssw.	......	......
2:12 p. m.	78.8	26.0	66	sw.	14	6.3	4,025	1,227	65.3	18.5	....	s.	......	......
2:26 p. m.	70.0	21.1	79	nw.	21	9.4	5,219	1,591	57.2	14.0	....	w.	......	......
2:38 p. m.	69.0	20.6	76	nw.	17	7.6	2,763	842	66.2	19.0	....	w.	......	......
2:44 p. m.	65.6	18.7	92	sw.	18	8.0	1,725	526	65.6	18.7	92	sw.	18	8.0
May 27:														
7:25 a. m.	70.0	21.1	75	nw.	14	6.3	1,725	526	70.0	21.1	75	nw.	14	6.3
7:36 a. m.	69.7	20.9	75	nw.	14	6.3	2,763	842	68.0	20.0	....	wnw.	......	......
7:45 a. m.	69.8	21.0	78	nw.	13	5.8	3,354	1,022	66.9	19.4	....	nw.	......	......
8:06 a. m.	70.4	21.3	75	nw.	13	5.8	4,189	1,277	64.0	17.8	....	nw.	......	......
8:37 a. m.	72.0	22.2	73	w.	9	4.0	5,052	1,540	62.6	17.0	....	wnw.	......	......
9:53 a. m.	73.8	23.2	70	w.	9	4.0	5,987	1,825	57.6	14.2	....	w.	......	......
10:05 a. m.	75.0	23.9	70	w.	10	4.5	5,102	1,555	61.3	16.3	....	wnw.	......	......
10:13 a. m.	74.3	23.5	72	nw.	10	4.5	3,465	1,056	66.4	19.1	....	wnw.	......	......
10:17 a. m.	74.5	23.6	71	nw.	10	4.5	2,562	781	70.2	21.2	....	wnw.	......	......
10:20 a. m.	74.8	23.8	70	w.	10	4.5	1,725	526	74.8	23.8	70	w.	10	4.5

RESULTS OF CAPTIVE BALLOON ASCENSION.

May 28:														
5:13 p. m.	78.2	25.7	64	s.	7	3.1	1,725	526	78.2	25.7	64	s.	7	3.1
5:17 p. m.	78.0	25.6	64	s.	7	3.1	4,507	1,374	67.1	19.5	....	s.	......	......
6:25 p. m.	77.6	25.3	57	s.	5	2.2	1,725	526	77.6	25.3	67	s.	5	2.2

May 26, 1908.—First flight: Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 7,400 ft. (2,256 m.); at maximum altitude, 5,500 ft. (1,676 m.)

A few St. Cu., moving from the west, were visible during the flight.

Second flight: Two kites were used; lifting surface, 142 sq. ft. (13.1 sq. m.). Wire out, 5,500 ft. (1,676 m.); at maximum altitude, 5,000 ft. (1,524 m.).

From 7/10 to 10/10 Cu. and Cu. N., moving from the south and southwest, were visible during the flight. A thunder-storm past near the station, and light rain fell after 2:40 p. m. At a height of 1,200 m. the kite past into the storm clouds.

A low was over Manitoba and a high over the coast of North Carolina.

May 27, 1908.—Five kites were used; lifting surface, 340 sq. ft. (31.5 sq. m.). Wire out, 10,000 ft. (3,292 m.); at maximum altitude, 8,000 ft. (2,438 m.).

About 4/10 Ci.-Cu. and 2/10 A.-St., moving from the west, were observed from the beginning to 9:06 a. m., and 6/10 Ci.-St. from the west from 9:06 a. m. to the end of the flight.

Pressure was low over Maine and relatively high over Tennessee.

May 28, 1908.—One captive balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 6,500 ft. (1,981 m.).

Ci.-St., moving from the west-southwest, and Cu., moving from the south, partly covered the sky.

Pressure was low over the Eastern States and high over New Brunswick.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
May 29:														
1:15 p. m.	73.4	23.0	77	se.	10	4.5	1,725	526	73.4	23.0	77	se.	10	4.5
1:36 p. m.	74.7	23.7	78	se.	8	3.6	2,308	703	70.7	21.5	....	se.	......	......
4:50 p. m.	72.4	22.4	82	se.	9	4.0	4,466	1,361	61.7	16.5	....	se.	......	......
5:08 p. m.	72.2	22.3	81	se.	8	3.6	3,279	1,000	65.1	18.3	....	se.	......	......
5:15 p. m.	72.7	22.6	80	se.	10	4.5	2,612	796	68.0	20.0	....	se.	......	......
5:18 p. m.	72.7	22.6	80	se.	10	4.5	1,725	526	72.7	22.6	80	se.	10	4.5
May 30:														
9:02 a. m.	65.3	18.5	98	nw.	12	5.4	1,725	526	65.3	18.5	98	nw.	12	5.4
9:13 a. m.	66.2	19.0	96	nw.	10	4.5	2,592	790	64.0	18.0	...	nnw.	......	......
10:52 a. m.	70.0	21.1	86	nw.	12	5.4	3,930	1,198	66.6	19.2	....	ne.	......	......
11:30 a. m.	71.0	21.1	83	nw.	12	5.4	2,573	784	65.3	18.5	....	nnw.	......	......
11:36 a. m.	71.0	21.7	84	nw.	12	5.4	1,725	526	71.0	21.7	84	nw.	12	5.4
June 1:														
7:40 a. m.	58.0	14.4	83	nw.	14	6.3	1,725	526	58.0	14.4	83	nw.	14	6.3
7:44 a. m.	58.3	14.6	83	nw.	16	7.2	2,983	909	51.8	11.0	....	nw.	......	......
8:04 a. m.	58.5	14.7	77	nw.	17	7.6	4,272	1,302	47.1	8.4	....	nw.	......	......
8:10 a. m.	59.0	15.0	78	nw.	17	7.6	4,920	1,500	43.7	6.5	....	wnw.	......	......
8:30 a. m.	57.3	14.1	80	nw.	16	7.2	5,645	1,721	39.4	4.1	....	wnw.	......	......
8:55 a. m	57.0	13.9	77	nw.	17	7.6	7,435	2,266	45.9	7.7	....	wnw.	......	......
9:30 a. m.	58.0	14.4	72	nw.	25	11.2	10,887	3,318	32.9	0.5	....	wnw.	......	......
9:55 a. m.	58.0	14.4	69	nw.	35	15.6	12,416	3,784	23.9	− 4.5	....	wnw.	......	......
10:35 a. m.	58.3	14.6	64	nw.	34	15.2	10,293	1,137	34.9	1.6	....	wnw.	......	......
11:03 a. m.	59.0	15.0	68	nw.	29	13.0	7,939	2,420	42.3	5.7	....	nw.	......	......
11:16 a. m.	58.4	14.7	64	nw.	28	12.5	6,027	1,837	47.5	8.6	....	nw.	......	......
11:35 a. m.	59.0	15.0	65	nw.	27	12.1	4,259	1,298	42.8	6.0	....	nw.	......	......
11:47 a. m	59.0	15.0	63	nw.	25	11.2	3,143	958	49.1	9.5	....	nw.	......	......
11:55 a. m.	58.0	14.4	62	nw.	23	10.3	1,725	526	58.0	14.4	....	nw.	20	10.3
June 2:														
7:48 a. m.	55.0	12.8	69	nw.	12	5.4	1,725	526	55.0	12.8	69	nw.	12	5.4
10:23 a. m.	61.8	16.6	62	nw.	13	5.8	2,380	726	60.3	15.7	....	nw.	......	......
10:48 a. m.	63.0	17.2	62	nw.	12	5.4	4,253	1,296	54.5	12.5	....	nne.	......	......
11:19 a. m.	64.0	17.8	56	nw.	12	5.4	5,431	1,655	49.1	9.5	....	nne.	......	......
11:50 a. m.	65.5	18.6	49	nw.	12	5.4	4,650	1,417	53.2	11.8	....	n.	......	......
12:00 m...	66.0	18.9	50	nw.	12	5.4	2,996	913	58.1	14.5	....	nw.	......	......
12:04 p. m.	67.0	19.4	50	nw.	12	5.4	1,725	526	67.0	19.4	50	nw.	12	5.4

May 29, 1908.—Four kites were used; lifting surface, 283 sq. ft. (26.2 sq. m.). Wire out, 9,000 ft. (2,743 m.); at maximum altitude, 5,000 ft. (1,524 m.).

About 8/10 clouds were visible, consisting of Ci., moving from the southwest and St. and St.-Cu. from the southeast.

At 8 a. m. a high was central over Rhode Island and a low over northern Iowa.

May 30, 1908.—Five kites were used; lifting surface, 351 sq. ft. (32.5 sq. m.). Wire out, 10,000 ft. (3,048 m.) at maximum altitude.

At the beginning the sky was overcast with St. moving from the northwest. The clouds gradually decreased to 2/10 St. at the end of the flight.

Pressure was high over the lower St. Lawrence and low over eastern Virginia and the Lake region.

June 1, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 21,500 ft. (6,553 m.); at maximum altitude, 20,000 ft. (6,096 m.).

At the time the first kite was launched the sky was nearly overcast with St.-Cu. moving from the west-northwest and St. moving from the northwest. The St. soon dispersed. The leading kite entered the base of the St.-Cu. at an altitude of 4,920 ft. (1,500 m.). By 9.30 a. m. the St.-Cu. had diminished to 1/10, and from that time to the end of the flight from 1/10 to 3/10 were usually present.

Pressure was low over New England and high over Lake Superior.

June 2, 1908.—Five kites were used; lifting surface, 351 sq. ft. (32.5 sq. m.). Wire out, 7,500 ft. (2,286 m.); at maximum altitude, 7,000 ft. (2,134 m.).

A few A.-St. near the horizon were visible during the latter part of the flight.

A high was central over the upper Lakes and a low over the lower St. Lawrence Valley.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. June 3:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters	° F.	° C.	%		Miles p. h.	Met's p. s.
2:50 p. m.	62.5	16.9	62	se.	9	4.0	1,725	526	62.5	16.9	62	se.	9	4.0
3:08 p. m.	63.0	17.2	65	se.	9	4.0	2,615	797	64.4	18.0	....	s.	......	......
4:12 p. m.	62.0	16.7	66	se.	10	4.5	3,337	1,017	59.9	15.5	....	sw.	......	......
5:17 p. m.	60.8	16.0	68	se.	9	4.0	4,557	1,389	52.8	11.6	....	sw.	......	......
5:29 p. m.	60.6	15.9	69	se.	9	4.0	2,918	888	58.6	14.8	....	s.	......	......
5:39 p. m.	60.0	15.6	71	se.	9	4.0	1,725	526	60.0	15.6	71	se.	9	4.0

RESULTS OF CAPTIVE BALLOON ASCENSION.

Date and hour.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.
June 4:														
7:11 p. m.	60.6	15.9	92	se.	5	2.2	1,725	526	60.6	15.9	92	se.	5	2.2
7:16 p. m.	60.0	15.6	94	se.	5	2.2	5,331	1,625	52.2	11.2	....	e.	......	......
7:19 p. m.	60.0	15.6	94	se.	5	2.2	3,724	1,135	55.9	13.3	....	ene	......	......
7:28 p. m.	60.0	15.6	94	se.	5	2.2	2,471	753	57.2	14.0	....	e.	......	......
7:41 p. m.	59.2	15.1	97	se.	5	2.2	1,725	526	59.2	15.1	97	se.	5	2.2

RESULTS OF KITE FLIGHTS.

Date and hour.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.
June 5:														
2:30 p. m.	69.7	20.9	62	se.	11	4.9	1,725	526	69.7	20.9	62	se.	11	4.9
5:17 p. m.	68.6	20.3	60	se.	12	5.4	2,589	789	57.2	14.0	....	e.	......	......
5:40 p. m.	68.6	20.3	60	e.	12	5.4	7,779	2,371	44.4	6.9	....	e.	......	......
6:05 p. m.	68.0	20.0	63	se.	12	5.4	5,866	1,788	49.8	9.9	....	e.	......	......
6:20 p. m.	67.2	19.6	65	e.	12	5.4	3,810	1,161	53.8	12.1	....	e.	......	......
6:25 p. m.	67.0	19.4	65	e.	12	5.4	3,152	961	61.7	16.5	....	e.	......	......
6:33 p. m.	67.0	19.4	65	e.	12	5.4	1,725	526	67.0	19.4	65	e.	12	5.4

June 3, 1908.—Four kites were used; lifting surface, 283 sq. ft. (26.2 sq. m.). Wire out, 6,000 ft. (1,829 m.); at maximum altitude, 4,500 ft. (1,372 m.).

The clouds, moving from the west, increased gradually from 7/10 Ci.-St. at the beginning to 10/10 A.-St. by the end of the flight.

Pressure was high over the Lake region and the Middle Atlantic States, and was low over southern Utah.

June 4, 1908.—One balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 5,500 ft. (1,676 m.).

When the balloon was launched the sky was 8/10 covered with St. moving from the east, at an altitude of about 2,700 ft. (823 m.). By 7.40 p. m. the clouds had increased to 9/10 and had settled down nearly to the level of the station, causing a light fog.

Pressure was low over South Dakota, and there was a slight depression over North Carolina. Pressure was high over New Jersey, Alabama, and the upper Lakes.

June 5, 1908.—Three kites were used; lifting surface, 262 sq. ft. (24.3 sq. m.). Wire out, 12,000 ft. (3,658 m.) at maximum altitude.

About 6/10 St.-Cu. were visible during the flight.

A high was central over the lower St. Lawrence Valley and a low over Montana.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.														
June 6:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
9:20 a. m.	55.6	13.1	100	e.	12	5.4	1,725	526	55.6	13.1	100	e.	12	5.4
10:05 a. m.	56.0	13.3	100	e.	14	6.3	2,507	764	63.1	17.3	....	ese	......	......
11:10 a. m.	56.0	13.3	100	e.	14	6.3	3,551	1,082	60.3	15.7	....	ese	......	......
11:20 a. m.	56.0	13.3	100	e.	13	5.8	2,971	906	55.0	12.8	....	ese	......	......
11:58 a. m.	57.0	13.9	100	se.	12	5.4	1,725	526	57.0	13.9	100	se.	12	5.4
June 8:														
6:56 p. m.	72.7	22.6	65	s.	9	4.0	1,725	526	72.7	22.6	65	s.	9	4.0
7:02 p. m.	72.5	22.5	65	s.	9	4.0	2,890	881	68.4	20.2	....	s.	......	......
7:40 p. m.	71.3	21.8	65	s.	10	4.5	3,684	1,123	64.4	18.0	....	ssw.	......	......
8:00 p. m.	71.0	21.7	71	s.	10	4.5	1,725	526	71.0	21.7	71	s.	10	4.5
June 9:														
2:04 p. m.	80.5	26.9	59	se.	8	3.6	1,725	526	80.5	26.9	59	se.	8	3.6
3:26 p. m.	76.0	24.4	63	s.	10	4.5	3,279	999	66.2	19.0	....	s.	......	......
4:10 p. m.	75.0	23.9	65	sw.	8	3.6	4,289	1,307	58.1	14.5	....	s.	......	......
4:26 p. m.	68.0	20.0	92	nw.	23	10.3	5,738	1,749	50.2	10.1	....	s.	......	......
4:40 p. m.	66.0	18.9	90	nw.	14	6.3	8,535	2,602	46.4	8.0	....	s.	......	......
4:45 p. m.	66.0	18.9	90	nw.	13	5.8	1,725	526	66.0	18.9	90	nw.	13	5.8
June 10:														
4:24 p. m.	76.2	24.6	62	ne.	4	1.8	1,725	526	76.2	24.6	62	ne.	4	1.8
4:30 p. m.	75.1	23.9	63	ne.	4	1.8	4,214	1,284	63.5	17.5	....	nw.	......	......
4:39 p. m.	74.0	23.3	64	n.	4	1.8	6,147	1,874	56.7	13.7	....	nw.	......	......
4:53 p. m.	73.8	23.2	65	ne.	4	1.8	4,250	1,296	62.6	17.0	....	nw.	......	......
5:15 p. m.	73.6	23.1	65	ne.	3	1.3	3,551	1,082	66.7	19.3	....	o	......	......
5:23 p. m.	74.0	23.3	66	ne.	3	1.3	2,473	754	70.5	21.4	....	o	......	......
5:25 p. m.	73.5	23.1	66	ne.	3	1.3	1,725	526	73.5	23.1	66	ne.	3	1.3

June 6, 1908.—Three kites were used; lifting surface, 204 sq. ft. (18.9 sq. m.). Wire out. 5,500 ft. (1,676 m.) at the maximum altitude.

Dense fog and misting rain prevailed during the flight. The fog lightened and the rain ended just after noon.

High pressure was central over New England and low pressure over the Rocky Mountains.

June 8, 1908.—Four kites were used; lifting surface, 330 sq. ft. (30.6 sq. m.). Wire out, 8,000 ft. (2,438 m.); at maximum altitude, 7,000 ft. (2,134 m.).

The sky was cloudless, except for a few St.-Cu. near the western horizon.

Pressure was high over northern Georgia and low over Lake Superior.

June 9, 1908.—Three kites were used; lifting surface, 257 sq. ft. (23.8 sq. m.). Wire out, 7,400 ft. (2,256 m.) at maximum altitude.

A thunder-storm from the south-southeast reached the station at 3:59 p. m. The clouds, which consisted of 2 Ci. from the west and 2 Cu. from the south at the beginning of the flight, increased to 10/10 N. when rain began at 3:59 p. m. The storm produced a rapid fall in temperature and change in the direction of the surface wind.

Low pressure prevailed over the lower St. Lawrence Valley and high over the South Atlantic and Gulf States.

June 10, 1908.—One balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 7,250 ft. (2,210 m.).

During the ascension 5/10 Ci.-St. from the west and 2/10 Cu. from the northwest were observed.

Pressure was high over eastern South Dakota and low over the lower St. Lawrence. A secondary depression was central over southern Virginia.

RESULTS OF CAPTIVE BALLOON ASCENSION.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908.					Miles	Met's							Miles	Met's
June 11:	° F.	° C.	%		p. h.	p. s.	Feet.	Meters.	° F.	° C.	%		p. h.	p. s.
4:34 p. m.	67.0	19.4	74	ese.	5	2.2	1,725	526	67.0	19.4	74	ese.	5	2.2
4:44 p. m.	68.0	20.0	74	se.	11	4.9	4,580	1,396	56.8	13.8	....	n.	......	......
4:55 p. m.	68.5	20.3	72	se.	6	2.7	6,773	2,064	47.1	8.4	....	nnw.	......	......
5:19 p. m.	67.6	19.8	75	se.	5	2.2	5,011	1,527	51.4	10.8	....	ne.	......	......
5:30 p. m.	68.0	20.0	75	se.	5	2.2	4,083	1,244	56.5	13.6	....	e.	......	......
5:40 p. m.	66.0	18.9	77	se.	5	2.2	2,686	819	60.8	16.0	....	se.	......	......
5:44 p. m.	66.0	18.9	77	se.	4	1.8	1,725	526	66.0	18.9	77	se.	4	1.8

RESULTS OF KITE FLIGHTS.

June 12:														
1:35 p. m.	71.0	21.7	64	se.	8	4.0	1,725	526	71.0	21.7	64	se.	8	3.6
1:45 p. m.	71.0	21.7	64	se.	8	3.6	2,701	823	65.8	18.8	....	sse.	......	......
2:52 p. m	73.0	22.8	65	s.	9	4.0	4,001	1,219	57.2	14.0	....	sse.	......	......
3:51 p. m.	72.8	22.7	62	s.	10	4.5	4,745	1,452	54.3	12.4	....	s.	......	......
4:07 p. m.	72.0	22.2	63	s.	8	3.6	3,580	1,091	57.9	14.4	....	s.	.....	......
4:20 p. m.	72.0	22.2	62	s.	8	3.6	2,597	792	64.6	18.1	....	s.	......	......
4:27 p. m.	73.0	22.8	65	s.	8	3.6	1,725	526	73.0	22.8	65	s.	8	3.6
June 13:														
9:50 a. m.	70.2	21.2	76	s.	7	3.1	1,725	526	70.2	21.2	76	s.	7	3.1
10:02 a. m.	70.0	21.1	72	s.	9	4.0	2,793	851	65.1	18.4	....	sse.	......	......
10:16 a. m.	70.7	21.5	70	se.	9	4.0	3,301	1,006	61.2	16.2	....	s.	......	......
10:35 a. m.	71.4	21.9	65	se.	10	4.5	4,211	1,284	65.1	18.4	....	s.	......	......
11:37 a. m.	72.8	22.7	57	se.	11	4.9	5,258	1,602	60.1	15.6	....	ssw.	......	......
12:01 p. m.	73.0	22.8	52	s.	12	5.4	4,118	1,255	64.0	17.8	....	s.	......	......
12:08 p. m.	73.5	23.1	52	s.	12	5.4	3,538	1,078	62.2	16.8	....	sse.	......	......
12:14 p. m.	73.6	23.1	51	s.	10	4.5	2,952	900	65.7	18.7	....	sse.	.....	......
12:22 p. m.	73.0	22.8	50	s.	10	4.5	1,725	526	73.0	22.8	50	s.	10	4.5

June 11, 1908.—One balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 7,200 ft. (2,195 m.).

The sky was nearly overcast with moderately low clouds in two distinct layers; the lower at an altitude of about 5,000 ft. (1,524 m.) moving from the east, the other somewhat higher and moving from the west.

Pressure was low over North Carolina and high over Lake Michigan.

June 12, 1908.—Four kites were used; lifting surface, 342 sq. ft. (31.6 sq. m.). Wire out, 9,000 ft. (2,743 m.); at maximum altitude, 5,000 ft. (1,524 m.).

About 2/10 Cu. were visible, the direction changing from southeast to south during the flight.

High pressure prevailed over the eastern and low pressure over the western half of the country.

June 13, 1908.—Four kites were used; lifting surface, 330 sq. ft. (30.6 sq. m.). Wire out, 10,000 ft. (3,048 m.); at maximum altitude, 7,700 ft. (2,347 m.).

Ci.-St. moving from the northwest and a few Cu. from the south partly covered the sky during the flight. A solar halo was visible at intervals from 9 to 11 a. m.

High pressure was central over eastern Virginia and southern New England; low pressure over Missouri.

RESULTS OF KITE FLIGHTS

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
1908. June 15:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:16 a. m.	65.3	18.5	96	nw.	12	5.4	1,725	526	65.3	18.5	96	nw.	12	5.4
7:38 a. m.	65.8	18.5	92	nw.	14	6.3	2,952	900	68.7	17.6	....	wsw.	......	......
7:49 a. m.	65.3	18.5	92	nw.	14	6.3	4,169	1,271	59.5	15.3	....	sw.	......	......
8:05 a. m.	65.0	18.3	94	nw.	12	5.4	5,842	1,781	51.4	10.8	....	sw.	......	......
8:21 a. m.	65.0	18.3	95	nw.	10	4.5	7,079	2,158	47.5	8.6	....	sw.	......	......
8:37 a. m.	65.0	18.3	92	nw.	11	4.9	8,816	2,687	41.0	5.0	....	sw.	......	......
9:15 a. m.	64.4	18.0	99	nw.	8	3.6	10,934	3,333	31.1	− 0.5	....	sw.	......	......
9:38 a. m.	64.7	18.2	99	nw.	11	4.9	8,818	2,688	36.5	2.5	....	sw.	......	......
10:06 a. m.	65.4	18.6	96	nw.	10	4.5	7,136	2,175	43.0	6.1	....	sw.	......	......
10:24 a. m.	66.0	18.9	96	nw.	9	4.0	5,708	1,738	49.5	9.7	....	sw.	......	......
10:49 a. m.	66.5	19.2	92	w.	3	1.3	3,991	1,216	57.9	14.4	....	sw.	......	......
10:57 a. m.	66.5	19.2	96	w.	3	1.3	1,725	526	66.5	19.2	96	w.	3	1.3
June 16:														
9:57 a. m.	56.3	13.5	67	nw.	27	12.1	1,725	526	56.3	13.5	67	nw.	27	12.1
10:04 a. m.	57.0	13.9	66	nw.	26	11.6	2,954	900	48.2	9.0	....	nnw.	......	......
10:16 a. m.	57.5	14.2	64	nw.	24	10.7	4,005	1,221	42.8	6.0	....	nnw.	......	......
10:55 a. m.	58.1	14.5	62	nw.	25	11.2	4,464	1,361	56.1	13.4	....	n.	......	......
11:34 a. m.	60.0	15.6	61	nw.	24	10.7	6,633	2,022	45.9	7.7	....	nnw.	......	......
12:45 p. m.	61.3	16.3	58	nw.	23	10.3	7,207	2,197	47.1	8.4	....	wnw.	......	......
12:58 p. m.	62.0	16.7	58	nw.	15	6.7	5,860	1,786	50.5	10.3	....	nw.	......	......
1:27 p. m.	63.0	17.2	56	nw.	13	5.8	5,084	1,550	54.3	12.4	....	n.	......	......
1:42 p. m.	64.0	17.8	57	nw.	15	6.7	4,069	1,240	56.3	13.5	....	nnw.	......	......
1:46 p. m.	65.0	18.3	57	nw.	15	6.7	2,905	885	50.0	10.0	....	nnw.	......	......
1:59 p. m.	64.0	17.8	57	nw.	13	5.8	1,725	526	64.0	17.8	57	nw.	13	5.8
June 17:														
1:29 p. m.	65.5	18.6	59	se.	9	4.0	1,725	526	65.5	18.6	59	se.	9	4.0
1:36 p. m.	64.8	18.2	58	se.	7	3.1	3,047	929	58.3	14.6	....	se.	......	......
4:32 p. m.	65.3	18.5	59	se.	7	3.1	3,723	1,135	53.8	12.1	....	se.	......	......
5:26 p. m.	65.4	18.6	59	se.	7	3.1	5,383	1,641	48.0	8.9	....	s.	......	......
5:38 p. m.	64.3	17.9	62	se.	9	4.0	4,673	1,424	47.1	8.1	....	se.	......	......
5:43 p. m.	64.0	17.8	61	se.	8	3.6	3,366	1,026	52.9	11.6	....	se.	......	......
5:49 p. m.	64.0	17.8	63	se.	8	3.6	2,821	860	57.9	14.4	....	se.	......	......
5:53 p. m.	64.0	17.8	66	se.	7	3.1	1,725	526	64.0	17.8	66	se.	7	3.1

June 15, 1908.—Three kites were used; lifting surface, 210 sq. ft. (19.4 sq. m.). Wire out, 15,000 ft. (4,572 m.); at maximum altitude, 14,600 ft. (4,450 m.).

The sky was overcast during the flight. Two layers of low clouds were observed; the lower at an altitude of 3,000 to 4,000 ft. (914 to 1,219 m.) moving from the west, and the higher moving from the southwest. Rain fell from 8:10 to 8:19 a. m. and from 8:29 a. m. to the end of the flight. Light fog set in at 8:58 a. m. and continued.

Pressure was high over Iowa and low over the lower St. Lawrence Valley.

June 16, 1908.—Four kites were used; lifting surface, 272 sq. ft. (25.2 sq. m.). Wire out, 18,000 ft. (5,486 m.); at maximum altitude, 16,000 ft. (4,877 m.).

From 5/10 to 1/10 St. moving from the west were visible until 11:48 a. m. and 1/10 Ci. from the west thereafter.

Low pressure prevailed along the New England coast and high over the Great Lakes.

June 17, 1908.—Four kites were used; lifting surface, 336 sq. ft. (31.1 sq. m.). Wire out, 7,700 ft. (2,347 m.); at maximum altitude, 5,500 ft. (1,676 m.).

The clouds decreased gradually from 7/10 Ci.-St. and 3/10 Cu. at the beginning, to 2/10 Ci.-St. from the west and 1/10 Cu. from the southeast by the end of the flight. A solar halo was observed from the beginning until 5:20 p. m.

An area of high pressure was central over southern New York and a trough of low pressure extended from Arizona northward to Canada.

RESULTS OF KITE FLIGHT.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft. Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity		At different heights above sea. Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
1908. June 18:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
8:42 a.m.	62.6	17.0	79	se.	9	4.0	1,725	526	62.6	17.0	79	se.	9	4.0
8:54 a.m.	68.0	17.2	77	se.	10	4.5	2,873	876	58.3	14.6	....	sse	......	......
10:30 a.m.	65.0	18.8	66	se.	10	4.5	4,412	1,345	55.2	12.9	....	s.	......	......
10:53 a.m.	66.3	19.1	66	s.	10	4.5	3,305	1,007	60.6	15.9	....	s.	......	......
11:01 p.m.	65.8	18.8	67	se.	10	4.5	2,921	890	58.8	14.6	....	sse	......	......
11:10 a.m.	66.1	18.9	66	se.	10	4.5	1,725	526	66.1	18.9	66	se.	10	4.5
June 19:														
7:13 a.m.	67.0	19.4	85	w.	10	4.5	1,725	526	67.0	19.4	85	w.	10	4.5
8:44 a.m.	70.3	21.3	80	w.	9	4.0	3,946	1,203	68.0	20.0	....	nw.	......	......
8:55 a.m.	71.1	21.7	79	w.	6	2.7	5,416	1,651	63.8	17.4	....	nw.	......	......
9:57 a.m.	75.5	24.2	76	se.	3	1.3	6,861	2,091	55.6	13.1	....	nw.	......	......
10:57 a.m	74.5	23.6	76	se.	6	2.7	5,409	1,649	61.0	16.1	....	nw.	......	......
11:09 a.m.	76.3	24.6	74	se.	6	2.7	4,447	1,355	65.3	18.5	....	nw.	......	......
11:18 a.m.	76.1	24.5	74	se.	6	2.7	3,139	973	68.7	20.4	....	nw.	......	......
11:20 a.m.	76.4	24.7	74	se.	6	2.7	1,725	526	76.4	24.7	74	se.	6	2.7
June 20:														
9:48 a.m.	68.0	20.0	81	nw.	25	11.2	1,725	526	68.0	20.0	81	nw.	25	11.2
9:51 a.m.	68.7	20.4	78	nw.	22	9.8	2,802	854	75.7	24.3	....	wnw.	......	......
10:00 a.m.	69.0	20.6	77	nw.	25	11.2	3,660	1,116	72.5	22.5	....	wnw.	......	......
10:18 a.m.	69.2	20.7	76	w.	23	10.3	4,841	1,476	68.7	20.4	....	wnw.	......	......
10:31 a.m.	69.5	20.8	77	nw.	22	9.8	6,012	1,832	64.6	18.1	....	w.	......	......
10:46 a.m.	69.6	20.9	79	nw.	24	10.7	7,660	2,335	61.3	16.3	....	w.	......	......
11:27 a.m.	72.0	22.2	81	nw.	23	10.3	12,428	3,788	34.2	1.2	....	w.	......	......
11:51 a.m.	74.0	23.3	78	nw.	24	10.7	14,435	4,400	21.0	— 6.1	....	w.	......	......
12:43 p.m.	74.8	20.8	71	nw.	18	8.0	16,290	4,965	19.9	— 6.7	....	wnw.	......	......
1:10 p.m.	76.7	24.8	71	w.	15	6.7	15,177	4,626	24.8	— 4.3	....	wnw.	......	......
2:00 p.m.	80.0	26.7	64	nw.	16	7.2	13,240	4,036	28.9	— 1.7	....	w.	......	......
2:35 p.m.	81.6	27.6	68	w.	14	6.3	10,321	3,146	45.9	7.7	....	wnw.	......	......
3:03 p.m.	82.0	27.8	65	nw.	16	7.2	6,820	2,079	61.3	16.3	....	w.	......	......
3:26 p.m.	81.1	27.3	65	nw.	14	6.3	4,038	1,231	70.3	21.3	....	wnw.	......	......
3:35 p.m.	80.0	26.7	72	nw.	14	6.3	2,934	894	75.0	23.9	....	w.	......	......
3:39 p.m.	80.0	26.7	71	nw.	14	6.3	1,725	526	80.0	26.7	71	nw.	14	6.3

June 18, 1908.—Four kites were used; lifting surface, 336 sq. ft. (31.1 sq. m.). Wire out, 10,000 ft. (3,048 m.); at maximum altitude, 7,500 ft. (2,286 m.).

The sky was partly covered with A.-St. and St.-Cu. moving from the west-southwest.

Pressure was high off the North Carolina coast and low over Manitoba.

June 19, 1908.—Four kites were used; lifting surface, 289 sq. ft. (26.7 sq. m.). Wire out, 10,140 ft. (3,091 m.); at maximum altitude, 7, 500 ft. (2,286 m.).

About 1/10 Ci.-St. moving from the west-northwest was present during the flight.

Pressure was high over eastern North Carolina and low over Manitoba.

June 20, 1908.—Six kites were used; lifting surface, 414 sq. ft. (38.3 sq. m.). Wire out, 33,000 ft. (10,058 m.); at maximum altitude, 31,000 ft. (9,449 m.).

The sky was nearly covered with A.-St. and St.-Cu. moving from the west until about noon, when the direction changed to west-northwest, and Ci.-St. moving from the west appeared. Cloudiness diminished to 4/10 by 1:40 p. m., but by 3:15 p. m. it had increased to 9/10, of which 7/10 was Ci.-St. A solar halo was visible at intervals from noon until 1:15 p. m., and again at 3:21 p. m.

Pressure was high southward from Virginia and Kentucky, and was low over the lower St. Lawrence.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.: Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.		At different heights above sea: Height.		Air temperature.		Rel. hum.	Wind. Dir.	Wind. Velocity.	
1908. June 22:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:29 a. m.	66.0	18.9	95	nw.	14	6.3	1,725	526	66.0	18.9	95	nw.	14	6.3
7:38 a. m.	67.0	19.4	93	nw.	14	6.3	2,706	825	70.5	21.4	....	nw.	....	....
7:52 a. m.	67.5	19.7	92	nw.	12	5.4	3,287	1,002	74.5	23.6	....	n.	....	....
8:53 a. m.	69.8	21.0	88	nw.	11	4.9	4,661	1,421	68.7	20.4	....	nne.	....	....
9:14 a. m.	70.3	21.3	88	nw.	9	4.0	6,193	1,888	61.2	16.2	....	n.	....	....
10:15 a. m.	74.0	23.3	82	nw.	8	3.6	7,526	2,294	60.6	15.9	....	n.	....	....
10:42 a. m.	74.0	23.3	77	nw.	7	3.1	1,725	526	74.0	23.3	77	nw.	7	3.1

RESULTS OF CAPTIVE BALLOON ASCENSION.

Date and hour.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.
June 23:														
3:15 p. m.	83.2	28.4	57	nw.	4	1.8	1,725	526	83.2	28.4	57	nw.	4	1.8
3:45 p. m.	83.5	28.6	57	sw.	4	1.8	7,821	2,384	59.2	15.1	....	o	....	....
4:00 p. m.	84.0	28.9	59	w.	3	1.3	6,871	2,094	62.8	17.1	....	o	....	....
4:20 p. m.	84.5	29.2	58	s.	2	0.9	4,871	1,485	70.5	21.4	....	o	....	....
4:39 p. m.	84.5	29.2	55	w.	3	1.3	3,209	978	76.3	24.6	....	o	....	....
4:48 p. m.	85.0	29.4	57	nw.	3	1.3	2,559	780	82.6	28.1	....	o	....	....
4:50 p. m.	85.0	29.4	60	nw.	4	1.8	1,725	526	85.0	29.4	60	nw.	4	1.8

RESULTS OF KITE FLIGHTS.

Date and hour.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%	Dir.	Miles p. h.	Met's p. s.
June 24:														
6:21 a. m.	73.0	22.8	69	nw.	12	5.4	1,725	526	73.0	22.8	69	nw.	12	4.5
6:31 a. m.	72.3	22.4	72	nw.	12	5.4	2,605	794	80.1	26.7	....	w.	....	....
7:40 a. m.	74.5	23.6	70	w.	12	5.4	3,544	1,080	77.7	25.4	....	wnw.	....	....
8:25 a. m.	77.0	25.0	64	w.	11	4.9	4,748	1,447	72.3	22.4	....	w.	....	....
8:36 a. m.	77.0	25.0	65	nw.	12	5.4	3,885	1,184	75.6	24.2	....	wnw.	....	....
8:43 a. m.	76.5	24.7	69	w.	14	6.3	2,856	871	78.3	25.7	....	nw.	....	....
8:48 a. m.	76.5	24.7	69	w.	12	5.4	1,725	526	76.5	24.7	69	w.	12	4.5

June 22, 1908.—Five kites were used; lifting surface, 346 sq. ft. (32 sq. m.). Wire out, 10,600 ft. (3,231 m.); at maximum altitude, 8,200 ft. (2,500 m.).

About 9/10 Ci.-St. were present moving from the west-southwest and a few St.-Cu. moving from the north. A solar halo was visible during the entire flight.

Pressure was high over eastern Tennessee and low over Nebraska.

June 23, 1908.—One balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 7,000 ft. (2,134 m.).

About 7/10 Ci.-St. and a few Cu. were visible moving from the northwest. A solar halo was observed until after 4 p. m.

At 8 a. m. low pressure was central over Iowa, and centers of high pressure lay over New England, Kentucky, Alabama, and Florida.

June 24, 1908.—Six kites were used; lifting surface, 419 sq. ft. (38.8 sq. m.). Wire out, 8,000 ft. (2,438 m.); at maximum altitude, 6,000 ft. (1,829 m.).

A few Ci. were present from the beginning to 7:18 a. m. The sky was clear during the remainder of the flight.

An extensive area of high pressure was central over western Nebraska and the pressure was low north of the Great Lakes.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. June 25:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:18 a. m.	64.2	17.9	89	nw.	19	8.5	1,725	526	64.2	17.9	89	nw.	19	8.5
7:24 a. m.	64.5	18.1	90	nw.	17	7.6	3,031	924	59.9	15.5	...	nw.	......	......
7:33 a. m.	64.5	18.1	90	nw.	17	7.6	4,001	1,220	58.3	14.6	....	nw.	......	......
7:50 a. m.	66.3	19.1	80	nw.	17	7.6	5,080	1,548	60.6	15.9	....	wnw.	......	......
7:58 a. m.	66.3	19.1	79	nw.	16	7.2	6,319	1,926	56.5	13.6	....	w.	......	......
8:21 a. m.	67.0	19.4	77	nw.	18	8.0	8,636	2,632	47.5	8.6	....	w.	......	......
9:28 a. m.	69.5	20.8	69	nw.	15	6.7	11,353	3,460	36.5	2.5	....	w.	......	......
10:46 a. m.	71.5	21.9	61	nw.	16	7.2	13,472	4,106	27.7	− 2.4	....	w.	......	......
12:15 p. m.	73.0	22.8	61	n.	9	4.0	12,417	3,785	29.5	− 1.4	....	w.	......	......
12:57 p. m.	74.0	23.3	62	n.	10	4.5	9,153	2,700	44.8	7.1	....	nw.	......	......
1:19 p. m.	73.0	22.8	60	n.	10	4.5	7,001	2,134	43.2	6.2	....	nw.	......	......
1:41 p. m	73.0	22.8	56	n.	9	4.0	4,533	1,382	54.9	12.7	....	nw.	......	......
1:53 p. m.	74.0	23.3	56	nw.	13	5.8	3,911	1,192	61.9	16.6	....	nw.	......	......
2:03 p. m.	75.0	23.9	51	nw.	13	5.8	2,800	853	69.1	20.6	....	nnw.	......	......
2:07 p. m.	74.5	23.6	51	nw.	13	5.8	1,725	526	74.5	23.6	51	nw.	13	5.8
June 26:														
7:06 a. m.	58.0	14.4	89	nw.	9	4.0	1,725	526	58.0	14.4	89	nw.	9	4.0
7:20 a. m.	59.6	15.3	85	nw.	12	5.4	2,965	904	58.3	14.6	....	ne.	......	......
7:30 a. m.	60.7	15.9	81	nw.	12	5.4	3,900	1,189	55.4	13.0	....	ene.	......	......
9:12 a. m.	63.7	17.6	75	nw.	10	4.5	4,841	1,476	52.3	11.3	....	n.	......	......
9:46 a. m.	64.0	17.8	73	nw.	9	4.0	6,780	2,067	44.6	7.0	....	n.	......	......
9:56 a. m.	64.4	18.0	71	n.	9	4.0	5,707	1,740	47.5	8.6	....	n.	......	......
10:04 a. m.	64.8	18.2	71	nw.	10	4.5	4,420	1,347	52.0	11.1	....	ne.	......	......
10:10 a. m.	65.6	18.7	70	n.	10	4.5	3,352	1,022	54.5	12.5	....	ne.	......	......
10:15 a. m.	66.0	18.9	70	nw.	10	4.5	2,602	793	59.0	15.0	....	n.	......	......
10:20 a. m.	66.4	19.1	70	nw.	9	4.0	1,725	526	66.4	19.1	70	nw.	9	4.0

RESULTS OF CAPTIVE BALLOON ASCENSION.

June 27.														
1:29 p. m.	73.0	22.8	46	ne.	2	0.9	1,725	526	73.0	22.8	46	ne.	2	0.9
1:45 p. m.	76.5	24.7	48	sw.	2	0.9	8,304	2,531	40.6	4.8	....	o	......	......
2:00 p. m.	76.0	24.4	43	n.	4	1.8	6,916	2,108	48.2	9.0	....	o	......	......
2:14 p. m.	74.2	23.4	42	n.	5	2.2	5,838	1,779	54.5	12.5	....	o	......	......
2:27 p. m.	73.8	23.2	41	n.	4	1.8	4,443	1,354	61.5	16.4	....	o	......	......
2:37 p. m.	74.0	23.3	44	nw.	4	1.8	3,445	1,050	64.8	18.2	....	o	......	......
2:47 p. m.	74.0	23.3	44	nw.	6	2.7	2,543	775	69.6	20.9	....	o	......	......
2:50 p. m.	74.0	23.3	40	nw.	3	1.3	1,725	526	74.0	23.3	40	nw.	3	1.3

June 25, 1908.—Seven kites were used: lifting surface, 482 sq. ft. (44.6 sq. m.). Wire out, 29,500 ft. (8,992 m.); at maximum altitude, 26,000 ft. (7,925 m.).

The sky was from 3/10 to 7/10 covered with clouds, mostly in two layers, the upper moving from the west, and the lower from the west-northwest, changing to northwest. The leading kite was in the upper clouds at an altitude of 13,000 ft. (3,962 m.), and in the lower clouds at an altitude of 6,500 ft. (1,981 m.).

Pressure was high over Kansas and low over New Brunswick, with a secondary depression over Georgia.

June 26, 1908.—Six kites were used; lifting surface, 414 sq. ft. (38.3 sq. m.). Wire out, 12,000 ft. (3,657 m.); at maximum altitude, 8,000 ft. (2,438 m.).

At the beginning 2/10 A.-Cu. from the west-northwest and a few Cu. from the north were observed. The higher clouds had disappeared at 9:38 a. m. and the lower clouds had increased to 2/10 Cu. at the end of the flight.

Pressure was high over Michigan and low over Montana.

June 27, 1908.—One balloon was used; capacity, 905 cu. ft. (25.6 cu. m.). Wire out, 7,900 ft. (2,408 m.).

About 3/10 Cu. moving from the north were visible.

Low pressure was central over South Dakota, and pressure was high from North Carolina to the Lakes.

RESULTS OF KITE FLIGHTS.

Date and hour.	On Mount Weather, Va., 526 m. 1,725 ft.						At different heights above sea.							
	Air temperature.		Rel. hum.	Wind.			Height.		Air temperature.		Rel. hum.	Wind.		
				Dir.	Velocity.							Dir.	Velocity.	
1908. June 29:	° F.	° C.	%		Miles p. h.	Met's p. s.	Feet.	Meters.	° F.	° C.	%		Miles p. h.	Met's p. s.
7:16 a. m.	70.7	21.5	62	w.	10	4.5	1,725	526	70.7	21.5	62	w.	10	4.5
7:26 a. m.	70.2	21.2	68	w.	13	5.8	2,934	894	70.9	21.6	....	wnw.	......	......
7:40 a. m.	70.0	21.1	68	w.	15	6.7	4,205	1,282	63.9	17.7	....	w.	......	......
8:52 a. m.	73.7	23.2	61	sw.	13	5.8	6,424	1,958	56.7	13.7	....	wsw.	......	......
9:13 a. m.	73.0	22.8	63	sw.	12	5.4	8,065	2,458	47.1	8.4	....	wsw.	......	......
9:49 a. m.	75.4	24.1	63	w.	13	5.8	9,596	2,925	38.8	3.8	....	wsw.	......	......
11:02 a. m.	79.5	26.4	55	sw.	10	5.4	12,360	3,767	33.1	0.6	....	w.	......	......
12:00 m.	80.3	26.8	54	sw.	10	4.5	15,288	4,658	21.6	− 5.8	..	w.	......	......
12:43 p. m.	81.5	27.5	54	w.	10	4.5	18,136	5,528	11.5	−11.4	....	w.	......	......
1:08 p. m.	83.2	28.4	51	w.	10	4.5	16,915	5,156	17.6	− 8.0	....	w.	......	......
1:40 p. m.	83.8	28.8	56	sw.	9	4.0	14,606	4,452	24.1	− 4.4	....	w.	......	......
1:58 p. m.	83.0	28.3	55	sw.	12	5.4	12,126	3,699	34.2	1.2	....	w.	......	......
2:09 p. m.	85.0	29.4	54	s.	10	4.5	12,132	3,698	32.0	0.0	...	w.	......	......
2:21 p. m.	82.2	27.9	56	s.	9	4.0	11,003	3,354	31.5	− 0.3	....	wsw.	......	......
2:29 p. m.	80.4	26.9	56	sw.	10	4.5	9,757	2,974	35.6	2.0	....	wsw.	......	......
2:45 p. m.	75.4	24.1	66	nw.	13	5.8	7,801	2,378	45.7	7.6	....	wsw.	......	......
2:56 p. m.	75.5	24.2	66	nw.	8	3.6	6,337	1,932	52.9	11.6	....	wsw.	......	......
3:08 p. m.	77.5	25.3	61	nw.	8	3.6	5,117	1,560	63.0	17.2	....	sw.	......	......
3:22 p. m.	78.7	25.9	61	w.	8	3.1	4,167	1,270	67.5	19.7	....	sw.	......	......
3:30 p. m.	77.0	25.0	63	nw.	9	4.0	2,964	903	75.7	24.3	....	sw.	......	......
3:35 p. m.	77.3	25.2	66	nw.	9	4.0	1,725	526	77.3	25.2	66	nw.	9	4.0
June 30.														
7:17 a. m.	67.9	19.9	84	nw.	11	4.9	1,725	526	67.9	19.9	84	nw.	11	4.9
7:26 a. m.	67.5	19.7	84	nw.	12	5.4	2,852	869	66.4	19.1	....	wnw.	......	......
7:40 a. m.	67.3	19.6	84	nw.	12	5.4	3,887	1,185	62.2	16.8	....	wnw.	......	......
7:57 a. m.	68.0	20.0	84	nw.	12	5.4	5,184	1,580	61.5	16.4	....	w.	......	......
8:19 a. m.	69.0	20.6	81	nw.	8	3.6	6,240	1,902	55.4	13.0	....	w.	......	......
8:39 a. m.	69.0	20.6	80	nw.	8	3.6	8,062	2,457	46.4	8.0	....	w.	......	......
8:52 a. m.	69.5	20.8	80	nw.	8	3.6	9,590	2,923	37.4	3.0	....	wsw.	......	......
9:17 a. m.	70.0	21.1	80	nw.	10	4.5	10,833	3,302	31.6	− 0.2	....	wsw.	......	......
9:30 a. m.	71.3	21.8	80	nw.	11	4.9	11,744	3,580	29.3	− 1.5	....	wsw.	......	......
9:48 a. m.	72.0	22.2	80	nw.	10	4.5	12,506	3,812	26.6	− 3.0	....	wsw.	...	......
10:18 a. m.	73.0	22.8	77	nw.	11	4.9	12,847	3,916	25.7	− 3.5	....	wsw.	......	......
10:30 a. m.	73.0	22.8	79	nw.	11	4.9	13,580	4,139	19.8	− 6.8	....	wsw.	......	......
11:10 a. m.	73.0	22.8	70	nw.	13	5.8	11,460	3,493	30.2	− 1.0	....	wsw.	......	......
11:38 a. m.	73.0	22.8	72	nw.	10	4.5	9,689	2,938	36.5	2.5	....	wsw.	......	......
11:59 a. m.	75.7	24.3	71	nw.	9	4.0	5,225	1,595	56.7	13.7	....	w.	......	......
12:04 p. m.	74.3	23.5	73	nw.	7	3.1	3,502	1,067	64.4	18.0	....	nw.	......	......
12:14 p. m.	75.5	24.2	69	nw.	7	3.1	1,725	526	75.5	24.2	69	nw.	7	3.1

June 29, 1908.—Seven kites were used; lifting surface, 482 sq. ft. (44.6 sq. m.). Wire out, 30,000 ft. (9,144 m.) at maximum altitude.

At the beginning 1/10 Ci.-St. and 3/10 Cu. were present moving from the west. The Ci.-St., which had increased to 8/10 by 8:30 a. m., had entirely disappeared by noon. Cu. diminished during the morning hours, but increased to 6/10 during the afternoon. From 1/10 to 3/10 A.-Cu. were present during the afternoon moving from the west. The leading kite was in the A.-Cu. at an altitude of 12,132 ft. (3,698 m.), and in the Cu. at altitudes ranging between 9,757 ft. (2,974 m.) and 7,801 ft. (2,378 m.). A thunder-storm past over the Shenandoah Valley close to the station between 2 and 3 p. m. moving from the west-southwest. Light rain occurred at the station between 2:31 and 3 p. m.

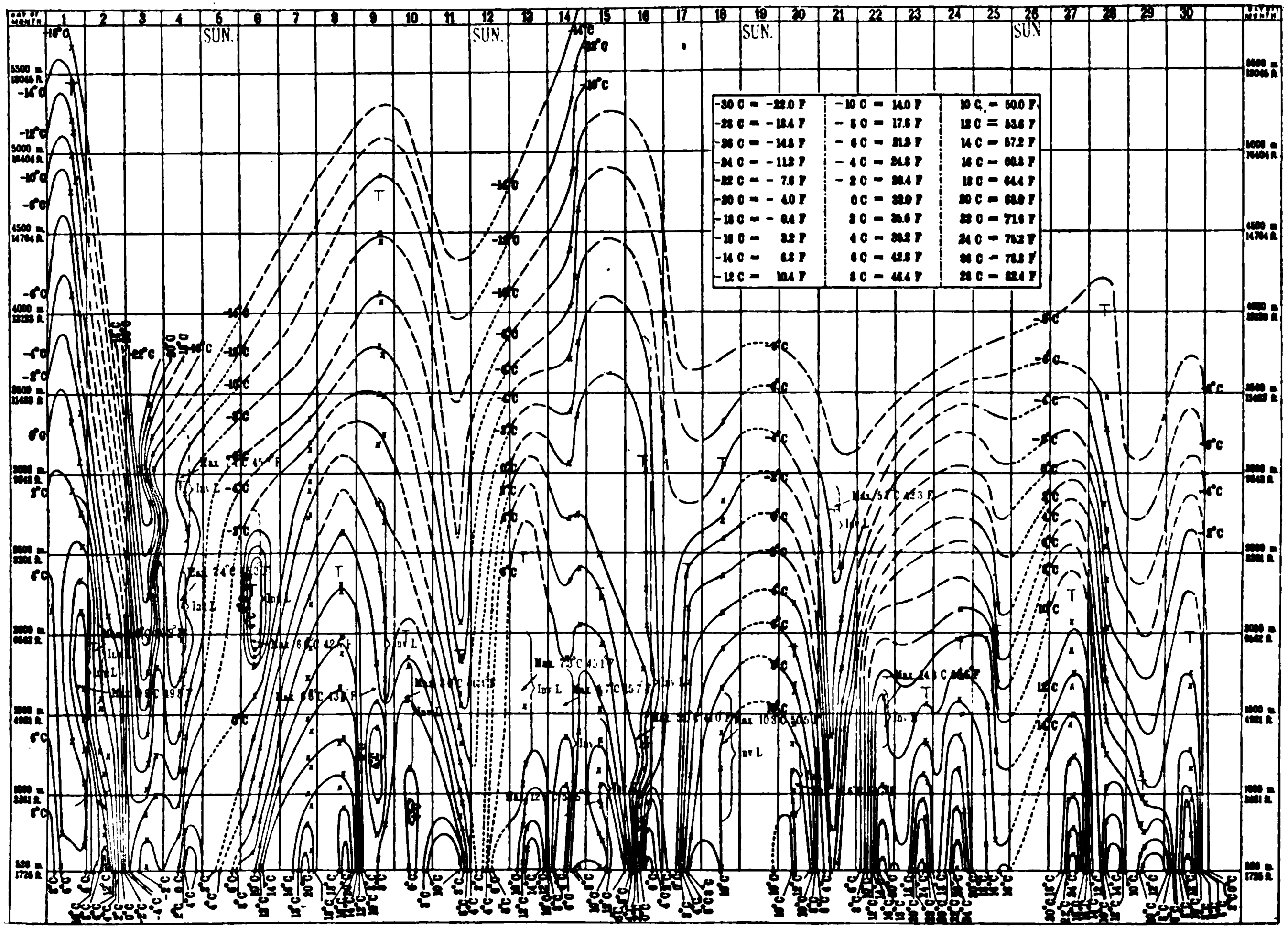
Pressure was high over North Carolina and Georgia and low north of Lake Superior.

June 30, 1908.—Five kites were used; lifting surface, 278 sq. ft. (25.7 sq. m.). Wire out, 25,000 ft. (7,620 m.); at maximum altitude, 24,000 ft. (7,315 m.).

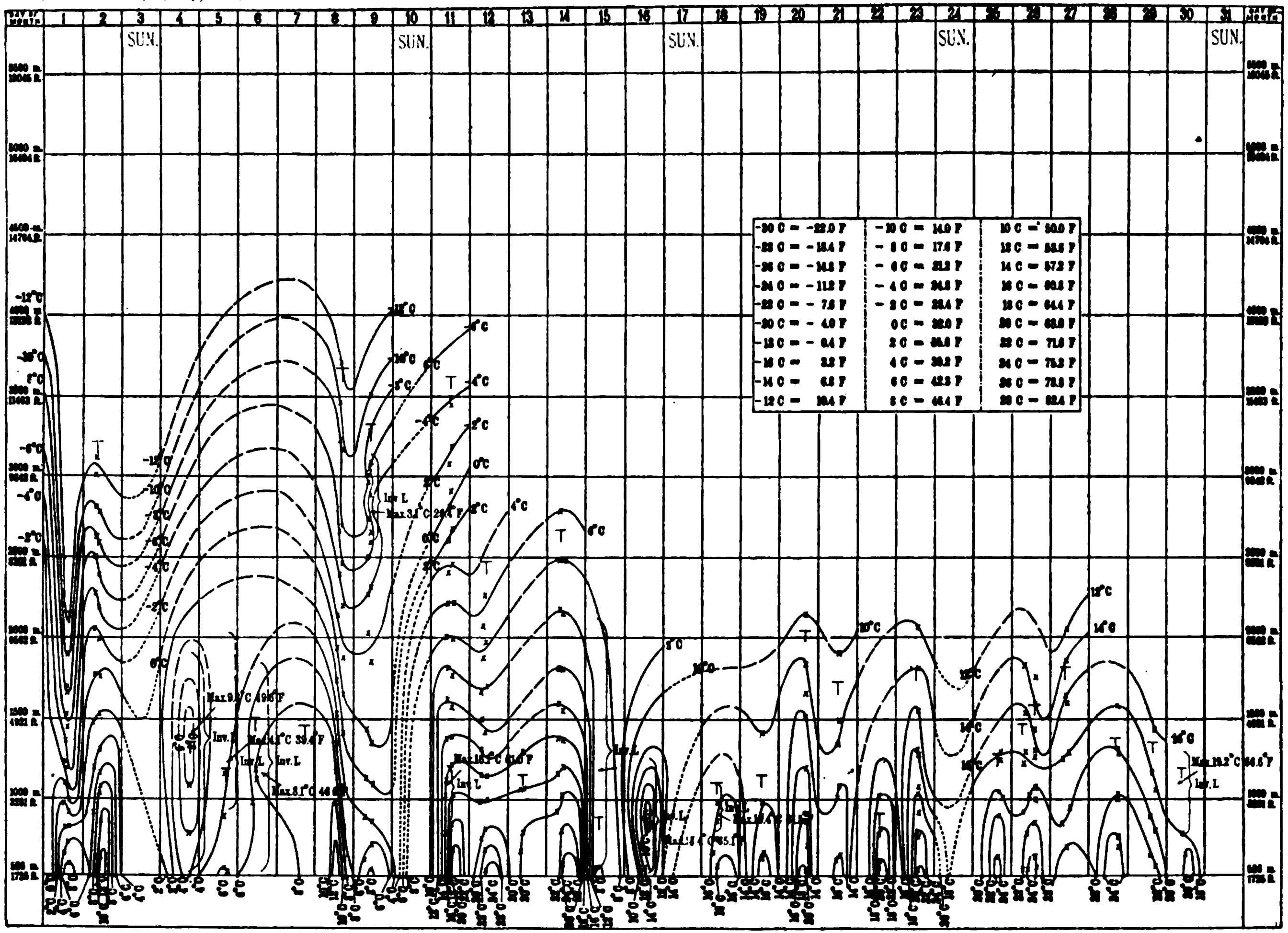
About 8/10 A.-Cu. were visible moving from the west.

A low was central over the lower St. Lawrence Valley and a high over the North Carolina coast.

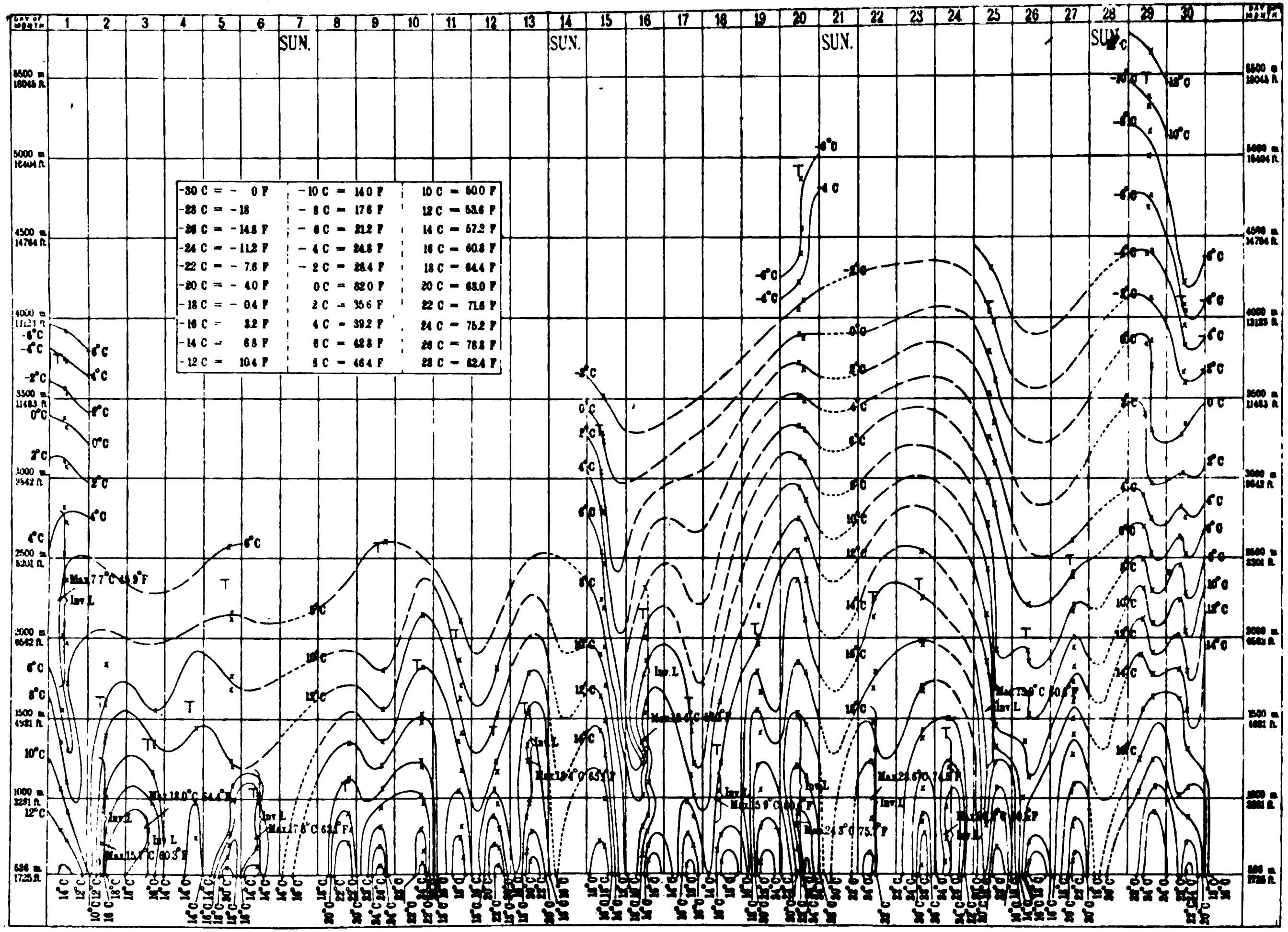
O



Upper air isotherms, April, 1908.



Upper air isotherms, May, 1906.



Upper air isotherms, June, 1908.

1 JAN. 19, 9

2 Nov. 2